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North Slope Expedited Response Action Proposal

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United States
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1.0 INTRODUCTION

The U.S. Department of Energy (DOE) currently owns approximately 140 mi^2 of land north and east of the Columbia River (referred to as the North Slope) that is part of the Hanford Site (Figure 1-1). The North Slope was not used for plutonium production or support facilities. The area was used for site defense. A total of seven antiaircraft gun emplacements and three Nike missile positions were located on the North Slope. These military positions were eventually closed as the defense requirements at Hanford changed. Prior to government control in 1943, the North Slope was homesteaded.

DOE currently leases approximately 25% of the North Slope area to the U.S. Fish and Wildlife Service. This area is managed as a wildlife refuge with limited public access. The remaining 75% of the North Slope is leased to the Washington Department of Wildlife and is operated as a wildlife management area that is opened to the public during daylight hours (Figure 1-2).

With the recent change in mission at Hanford from plutonium production to environmental cleanup, much attention has been given to releasing relatively clean tracks of land for other uses. The North Slope area is considered to be one of these relatively clean tracks of land. The area was selected as an expedited response action (ERA) site to facilitate its cleanup and release.

The North Slope is a non-time-critical ERA. This requires an engineering evaluation/cost assessment (EE/CA) per Federal Register, Vol. 55, No. 46, March 8, 1990, p. 8843, and 40 CFR 300.415. The EE/CA is similar to a feasibility study that considers applicable or relevant and appropriate requirements (ARAR), protection of the environment and human health, timeliness, effectiveness, and cost to select a preferred alternative.

1.1 GOAL

The goal of the ERA is to conduct early remedial actions in an area accessible to the public prior to the occurrence of an injury or exposure to potentially hazardous wastes (WHC 1992a). The potential hazards include refuse disposal areas, drywells, acid neutralization pits, and the 2,4-D disposal site. Physical hazards will also be mitigated as necessary to minimize possible injury to wildlife and persons using the area.

Since the initiation of this ERA, DOE has signed an agreement in principle with the Washington Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA), in which they agreed to further expedited cleanup of the North Slope. Remediation activities will make the North Slope area available for future non-DOE uses. The field activities are to be completed by October 1994.

The level to which these areas will be remediated is dependent on the future land use. Potential land uses identified include agriculture, residential, or retaining it as a wildlife management/refuge area.

Figure 1-1. Location of the Hanford Site North Slope.

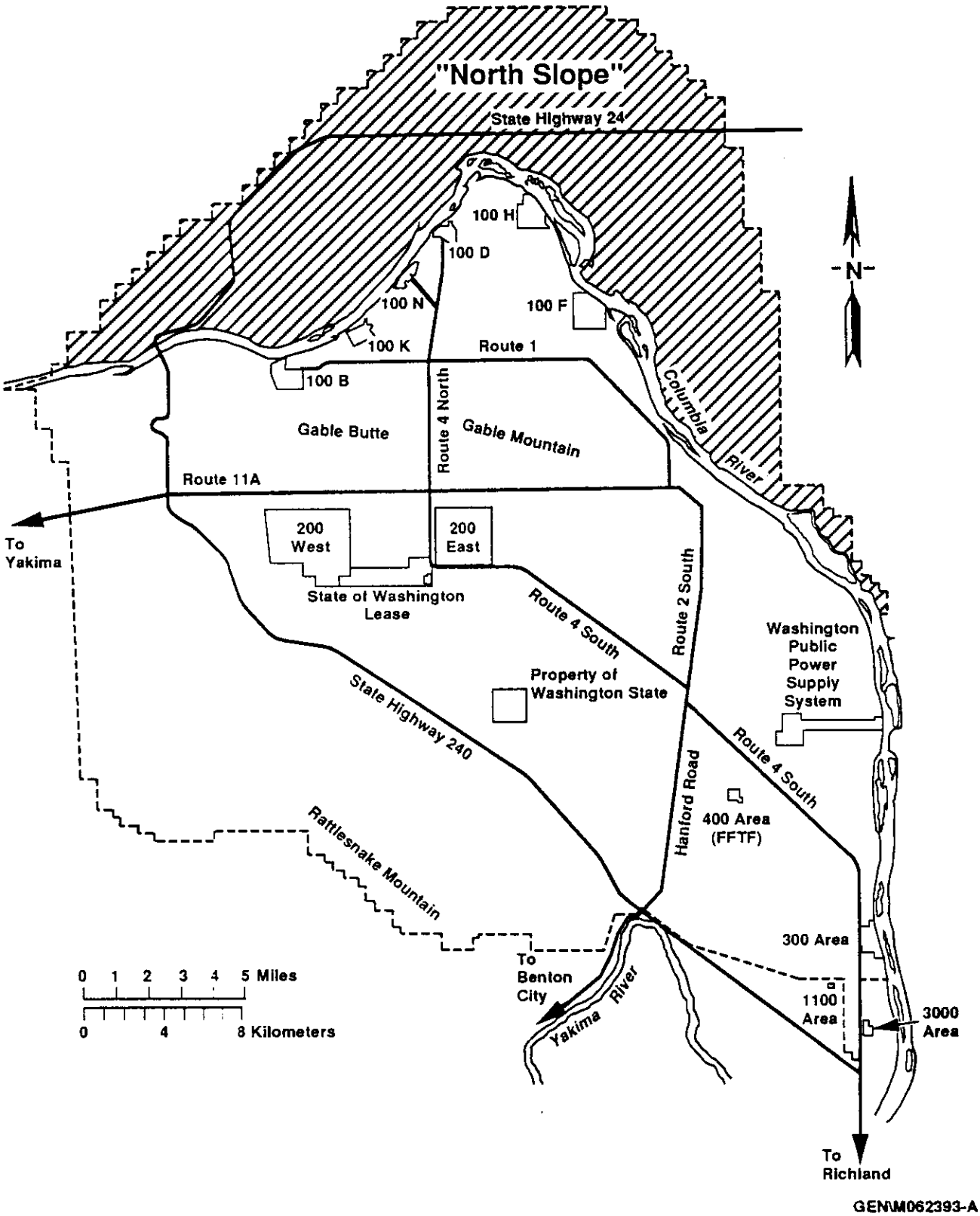
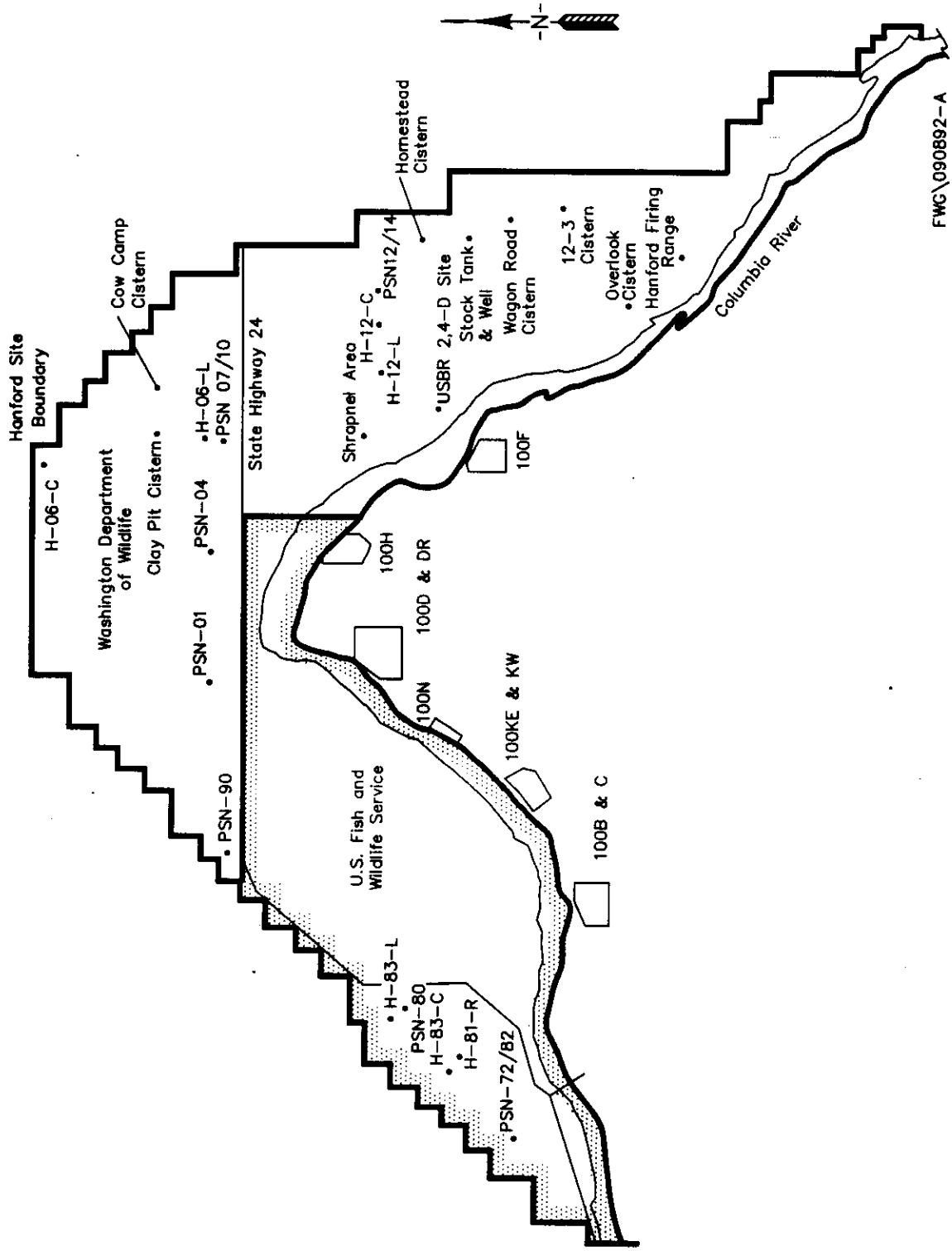


Figure 1-2. Location of North Slope Waste Sites.



1.2 BACKGROUND

The North Slope includes two small waste sites that are identified in the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) (Ecology et al. 1989) as the 100-IU-3 Operable Unit. The waste sites are the 2,4-D herbicide contaminated soil and storage tank landfill and the Battery A (H-06) Nike missile site (Figure 1-2). These sites and several other areas of military origin must be investigated for possible environmental and ordnance/explosive waste hazards prior to excising the property from DOE control. Physical hazards associated with the military emplacements as well as homesteading activities must be mitigated prior to excising the property.

The two Tri-Party Agreement listed sites will undergo investigation/remediation in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The ERA process (Gustafson 1991) is being utilized to address these sites under CERCLA. The remaining non-Tri-Party Agreement listed sites are being addressed under landlord maintenance processes simultaneously. Actions taken at the Tri-Party Agreement listed and non-Tri-Party Agreement listed sites will be consistent.

Thirty-nine sites have undergone characterization to determine if significant environmental hazards exist. This proposal documents the results of that characterization and evaluates the potential remedial alternatives. Remedial alternatives have been selected for waste sites mandated for investigation/cleanup under CERCLA in an EE/CA.

Ecology is the lead regulatory agency for the 100-IU-3 Operable Unit. On completion of a technical review of the proposal and subsequent public comment, the EPA and Ecology will issue the action memorandum directing the preferred course of action to be taken at these sites.

2.0 CHARACTERIZATION ACTIVITIES

North Slope characterization activities included historical research (including interviews with former military personnel stationed on the North Slope), site inspections, and environmental sampling of potential waste sites. The following sections describe each of these activities.

2.1 HISTORICAL RESEARCH AND SITE INSPECTIONS

The North Slope was homesteaded from the late 1800's until the federal government took control of the area in the early 1940's. After government acquisition, the area was used for military defense of the Hanford Site. The North Slope originally consisted of seven antiaircraft gun positions. These positions were replaced in the 1950's with three Nike missile positions, Since approximately 1960, there has been no permanent military installation on the North Slope. However, the area has been used for military training maneuvers (WHC 1990).

Since 1975, the 134-mi^2 area permitted by DOE to the Washington Department of Wildlife and the U.S. Fish and Wildlife Service has been opened for public access or designated as a wildlife refuge. Certain areas included in the wildlife management area have been opened for cattle grazing to ranchers who obtain grazing agreements.

In 1990, an extensive investigation of the North Slope area was performed to assess potential health, safety, and environmental concerns raised to DOE by Ecology and the public. As a result of this survey, 39 sites associated with either military or homesteading activities were discovered on the North Slope. The following section summarizes information from the *North Slope Investigation Report* (WHC 1990).

2.1.1 Military Sites

Military records from by the U.S. Army Cops of Engineers identify three Nike missile sites and seven antiaircraft sites positioned on the North Slope. Evidence remaining of these sites include reinforced-concrete foundation pads, scattered bottles and metal cans, and solid waste landfill disposal areas. Aboveground structures have been demolished. Five water well structures made of reinforced-concrete remain. Other underground structures have been destroyed or filled in. Exceptions are two rooms at a radar site and a few small structures at other sites.

Many of the buildings and permanent structures associated with these sites remained in place until the early to mid 1970's. These landmarks were demolished under DOE direction as they were determined to be an attractive nuisance. Information concerning the decommissioning and demolition activities at these military sites is sketchy.

Historical research on the North Slope military structures located facility drawings for each of the Nike missile sites. The Nike installations are similar in construction and layout. Each site consisted of a control center (designated as C), a launch site (designated as L), and associated barracks and administration buildings. An early-warning radar site is also associated with each of the facilities.

Reports from personnel assigned to military units at and near the North Slope indicate that there was no centralized refuse disposal system in operation. Several landfills associated with the military operations are evident. Investigation of debris at the surface of these disposal areas reveals the typical range of military camp items (e.g., food cans and bottles, motor pool refuse, office and personal supplies) and debris from site demolition activities.

Remnants of the military outposts include reinforced-concrete pads, scattered surface debris, gravel walkways, building rubble, dry wells, and five water wells. The numerous trees associated with each of the sites are still present. Two underground structures associated with one of the anti-aircraft sites are also discernible.

The water well structures are typically 2 to 3 ft tall and extend into subsurface chambers approximately 6 by 8 by 10 ft deep. The well shaft is located on the floor of the chamber. Most of these structures have metal

covers that can be opened. The well covers were locked to prevent unauthorized access. The public has cut locks and latches off to open the doors. Efforts at opening the covers have been so persistent that even spot welding the doors shut has been ineffective.

The debris found in the vicinity of the military sites include oil and lubricant cans ranging in size from 1 qt to 5 gal. Only a few cans were found to have small volumes of oil in them. These cans have collected dust, plant debris, and insect bodies so that no free liquid remains. Paint cans are also common and some are partially full of dried paint. Several empty 1-gal solvent cans have been found. Nothing has been found that is considered to be an imminent environmental hazard to personnel or the environment.

Each military site contains scraps of asbestos-transite siding from building structures. The pieces are generally small, apparently overlooked as materials were being removed from the sites during the demolition activities. Personnel associated with site demolition activities indicate that building structures were knocked down and buried in pits near the original locations.

Each military site was reported to have had its own small motor pool. Major, nonroutine vehicle maintenance were completed at the main-Hanford motor pool located across the Columbia River. Only routine maintenance was performed at the military sites. Reports indicate that standard procedure at that time was to use used oil for dust control on roadways. Some of the military sites have maintenance areas with sunken grease pits and concrete ramps for convenient access by mechanics to the underside of vehicles.

Several drywells associated with the military sites have been located. The drywells consist of 55-gal drums, buried vertically to the rim with holes punched into the bottom to allow for percolation of the disposed liquid. Additional drywells appear on facility drawings available for the Nike missile positions. Field investigations were unable to located these additional structures. The inconsistencies between the drawings and actual field observations indicate that these drawings are not as-built plans.

Facility drawings also indicate the use of underground fuel tanks. Geophysical surveys failed to detect the presence of these tanks. An interview with a former soldier stationed at Nike position H-83-C indicated that the tanks were not underground but rather of the skid-mounted variety. It may also be possible that the tanks were removed during the decommissioning activities.

In addition to the military camps, three sites were found or reported that may contain unexploded ordnance. Interviews with former personnel assigned to the North Slope military sites indicate that unexploded ordnance may have been disposed of in random locations throughout the area. The three potential ordnance sites were investigated by personnel from the U.S. Army Explosive Ordnance Division, Department of the Army, 53rd Ordnance Detachment, with assistance from the Hanford Site Patrol and Westinghouse Hanford Company. The Explosive Ordnance Division performed a records search, conducted personal interviews, and completed walk-through surveys of the area, sweeping the area with mine-detecting equipment where appropriate. No unexploded ordnance was located during this investigation.

2.1.2 Non-Military Sites

Prior to the federal government's acquisition of the North Slope, the area was used for orchards and row crops near the Columbia River, wheat on the high ground away from the river, and as a grazing area where soil conditions would not allow the raising of crops.

Homestead structures (e.g., homes and outbuildings) were leveled and removed during the mid-1970's along with the military structures. Typically, homestead locations can be identified by scattered cans, bottle shards, and pieces of weathered lumber. Occasionally, a section of fenceline, a water cistern, or refuse disposal pit may remain.

Cisterns were structures used for the storing of water for domestic and livestock use. Seven cisterns have been located on the North Slope. They are typically concrete- or mortar-lined and range in size from 3 to 10 ft in diameter and 4 to 14 ft deep. Cisterns that are relatively intact may present a physical hazard to persons and livestock. A person or animal falling into one of the larger cisterns may be injured, and the shear walls may make escape without assistance difficult.

No specific environmental hazards have been found associated with the homestead refuse pits. One former resident indicated that, because money was scarce, canned goods were expensive and rarely purchased. Most goods came in paper containers. Anything that could be reused was, and the few items that could not be re-used were burned.

Historic usage of pesticides included lime sulphur and lead arsenate. In latter years, DDT and other pesticides may have been used. No areas have been found that are suspected of being pesticide disposal areas.

Soil contaminated with the herbicide 2,4-D from four leaking tanks owned by the U.S. Bureau of Reclamation was disposed of on the North Slope in 1966.

2.2 ENVIRONMENTAL SAMPLING ACTIVITIES

It was the objective of the sampling effort to determine if hazardous substances are present in the landfills at levels that warrant remedial efforts. An analogous approach to sampling was taken when practicable due to the large number of similar waste sites located on the North Slope. Disposal areas such as landfills associated with each of the military sites were assumed to contain similar wastes. The basis for this assumption results from similar activities being performed at each of the sites by the same organization at the same time, using the sample operational procedures. These types of waste sites include landfills, acid neutralization pits, and cisterns.

If the waste site was considered to be one-of-a-kind or was suspected of being a potential hazardous liquid disposal site, the site was individually sampled. These types of waste sites include drywells and the 2,4-D landfill. It is important to note that the North Slope area was never used for nuclear activities and has been radiologically released.

Table 2-1 lists areas identified in the original North Slope survey performed in 1989-90. A summary of the investigative activities performed at the site is included. Figure 1-2 shows the location of the more significant sites. Offsite laboratory analytical results are provided in Appendix A. Field screening results are provided in Appendix B. A description of the investigation activities at each of these sites is provided in the following sections.

Table 2-1. North Slope Military Installations and Associated Suspect Waste Sites.

Site Name	Description	Investigative Activities
Military Construction Dump[a]	Demolished wooden buildings, construction debris, lubricant cans, auto parts (greatest concentration scattered over 2-acre area).	Visual surface investigation, no environmental hazards identified.
H-06-C	Radar control site for H-06-L. Concrete foundation pads, leveled area on north side of access road may be disposal area, below site in "saddle" is a few 5- and 55-gal drums and other small quantities of trash.	Visual inspection, transite tile remains on foundation pads. No other environmental hazards identified.
H-06-L	Nike missile launch site. All surface structures leveled (foundations, roadways, parking areas, and drainage structures only remain). One drywell made from metal drum also located at site. Some scattered surface debris. Access to underground rooms partially excavated with exposed rebar.	Drywell was sampled, no environmental hazards identified.
H-06-L Disposal Area	About 2 to 3 acres in size. Disturbance of soil is apparent. Debris on surface includes paint cans, construction materials, asbestos siding, asbestos brake pad.	Landfill sampled, no environmental hazards other than asbestos materials identified.
H-12-C	Radar site for Nike missile launch H-12-L. Communication wire leading from site, trench north of site (no evidence of buried material), some paint and lubricant cans, some exposed rebar at building foundations.	Visual inspection, no environmental hazards identified.
H-12-L	Nike missile launch site. Concrete foundations, entrance to underground rooms and electrical access port partially excavated, soil depression at northwest corner of site (potential disposal site).	Acid neutralization pit sampled. No environmental hazards identified.
H-12-R	Potential radar site. Remains of wood structures, piles of domestic garbage, several 5-gal oil cans, 5-gal drums, auto parts, concrete footings.	Visual inspection, no environmental hazards identified.
H-81-R	Potential radar site. Concrete footings, large disturbed area at west side of site (potential disposal area), soil berm contains refuse (batteries, bottles, etc.), 55-gal drum buried flush to ground (unknown function).	Visual inspection, no environmental hazards identified.

Table 2-1. North Slope Military Installations and Associated Suspect Waste Sites. (Continued)

Site Name	Description	Investigative Activities
H-83-C	Radar site for Nike missile launch H-83-L. Well structure (mostly filled in), small pit containing several hundred rounds of fired 30-06 blank ammunition along with links for belt-fed automatic weapons, tires, small trench west of site (potential disposal area).	Attempted to sample drywells identified in facility drawings. Excavations could not locate structures. No environmental hazards identified.
H-83-L	Nike missile launch site. Buildings removed, well structure, underground launch structures filled in, potential disposal area north of site, area of approximately 50 acres has a large amount of trash scattered over it.	Sampled landfill areas, no environmental hazards identified.
Igloo Site	Ammunition storage site. Buildings removed, area generally clean except for several broken boxes that contained 120-mm gun ammunition.	Visual inspection, no environmental hazards identified.
PSN 01 (H-01)	Antiaircraft gun site. Well structure, areas south/west/north of site potential disposal areas.	Visual inspection, no environmental hazards identified.
PSN 04 (H-04)	Antiaircraft gun site. Gun sandbag enclosures, well structure, disposal sites southeast of site, cat scars north and south of site, six empty blue plastic 55-gal drums (photographic chemical) east of site.	Sampled landfill areas. no environmental hazards identified.
PSN 07/10 (H-07)	Antiaircraft gun site/headquarters for Nike launch site H-06-L. 55-gal drum, drywell, motor pool grease pit, underground wood structured (3- by 8-ft by 18 in. deep) of unknown use, concrete-lined pit of unknown use, pavement and building foundations, mostly filled in homestead cistern is northwest of site.	Sampled drywell associated with grease pit, no environmental hazards identified.
Land Mine Site (PSN 07/10)	Two practice antitank land mines were found just southwest of PSN 07/10.	Land mines were removed.
PSN 12/14 (H-14)	Antiaircraft gun site/barracks area in association with nearby Nike missile site. Small burial site with metal paint cans and metal scraps, large dump site southeast of 12/14 containing mainly commissary type garbage, wringer washing machine, water tank and heater, packing boxes for antiaircraft gun shells, and well structure.	Visual inspection, no environmental hazards identified.
PSN 72/82 (H-82)	Antiaircraft gun site. Small disposal pits containing oil cans and antiaircraft gun shell packing boxes, two plywood boxes buried flush to ground (one containing empty lubricant cans), 22-caliber firing range at northeast corner of site, gun emplacements and aboveground structures are leveled, and well structure.	Visual inspection, no environmental hazards identified.

Table 2-1. North Slope Military Installations and Associated Suspect Waste Sites. (Continued)

Site Name	Description	Investigative Activities
PSN 80	Barracks area in association with Nike launch site/ antiaircraft gun site. Concrete foundation pads.	Visual inspection, no environmental hazards identified.
PSN 90 (H-90)	Antiaircraft gun site. In-service well, concrete vehicle maintenance ramp, vehicle maintenance building foundations along with other foundations, soil piles with debris in them and scattered surface debris west of the site.	Vehicle maintenance ramp demolished, partial removal of oil-saturated soils. Sampled oil dump site. No other environmental hazards identified.
PSN 90 Disposal Site	Contains tent parts, electronic equipment, auto parts, several small pits (some with debris in them, and one had sand bags around perimeter).	Visual inspection, no environmental hazards identified.
Underground Wood Room Site	Located just southeast of PSN 04. Site consists of three underground wooden rooms (probable military origin, one room demolished), northwest of each room is a set of concrete pads, probably used for radar or guns.	Visual inspection, unable to enter structures for safety reasons. A dead calf could be seen in one of the rooms. No environmental hazards identified.
Antiaircraft Gun Shrapnel Sites	Consists of three known separate areas that contain shrapnel from antiaircraft gun firing. Shrapnel consists of iron fragments and aluminum or magnesium fuse ring pieces.	Visual inspection, area also investigated by ordnance teams. No ordnance nor environmental hazards identified.
Bridge Disposal Site	Located in saddle of hill overlooking Vernita Bridge. Area of a demolished building location or dump of probable military origin. Consists of three or four wood frame structures, metal roofing, window screen, railroad ties, oil cans, personal items (tooth brushes, razors), bottles, cans.	Visual inspection, no environmental hazards identified.
Homestead Cisterns	Nine known cisterns that consist of circular concrete-lined pits used to store water. Largest is 8 ft across and 14 ft deep. Three cisterns are filled in with soil, remainders have wood debris, wire, homestead trash (cans), or more recent trash consisting of oil cans, glass bottles, pesticide cans, paint cans, beverage containers, etc.	Field screening and offsite laboratory samples taken from two of the structures. No environmental hazards identified.
Stock Tank and Well Site	Consists of a barbed wire corral with a 12- by 12-ft by 4-ft deep concrete stock tank at the southwest corner. Top of tank is 2 ft aboveground. A cased well is just north of tank. Scattered metal cans and lumber are nearby.	Visual inspection, no environmental hazards identified.
Dune Homestead	Domestic trash disposal area southwest of trees, building locations nearby, flour mill parts, carriage parts.	Visual inspection, no environmental hazards identified.
Lonetree Homestead	Consists of one live cherry tree, several dead trees, no aboveground structures, metal cans, broken glass, garbage pit, and nearby wagon road.	Visual inspection, no environmental hazards identified.

Table 2-1. North Slope Military Installations and Associated Suspect Waste Sites. (Continued)

Site Name	Description	Investigative Activities
2,4-D Burial Site	Buried 2,4-D contaminated soil along with associated crushed empty tanks. This was all buried at the foot of a dune in 1966 and 1967.	Burial site sampled, no environmental hazards identified.
Asbestos Pipe Site	Sand blowout containing concrete/asbestos pipe and small amounts of other debris. Site is southeast of Nike launch site H-12-L.	Visual inspection, no environmental hazards other than asbestos identified.
Asphalt Batch Plant Site	Graveled area approximately 2 acres in size. Several small piles of asphalt and gravel are present, along with a pile of concrete and two pits with no apparent trash.	Visual inspection, no environmental hazards identified.
Coyote Bait Can	5-gal military type container with Bait Can written on it. Contents at bottom of can appear to be oily. Also an anchor stake for a leg-hole trap is nearby, along with a 5-gal fuel-type can.	Visual inspection, no environmental hazards identified.
Coyote Bait Station	Area of approximately 10 acres strewn with animal bones (coyote skulls, and large animal bones). Bones appear to be old.	Visual inspection, no environmental hazards identified.
Gravel Pit #47	Two apparently active gravel pits. Smaller pit has trash in it consisting of cans, bottles, fencing wire, wire spools, two military paint cans, and an oil can.	Visual inspection, no environmental hazards identified.
Gravel Pit #56	Consists of several pits but no signs of trash disposal except for some military communication wire.	Visual inspection, no environmental hazards identified.
Hanford Firing Range	Site consists of an area at foot of bluff used by early Hanford Site security forces. 55-gal drums present with holes in them from 30- and 50-caliber and 37-mm ammunition. A nearby trench contained metal boxes for 55-caliber rounds, 50-caliber brass, links from 50-caliber machine gun belts, and packing tubes for 37-mm rounds. Spent ammunition slugs have been found at site.	Area investigated by ordnance teams. No unexploded ordnance were located. No environmental hazards identified.
Wahluke Schoolhouse	Consists of concrete steps from former schoolhouse.	Visual inspection, no environmental hazards identified.

[a]Located 2/3 mi north and east of military site PSN 12/14.

2.2.1 Landfills

There are 10 landfills associated with the former military installations on the North Slope. The specific contents of the military landfills is unknown. It is probable, based on debris scattered on the surface, that domestic trash and demolition debris were disposed of at these sites. It is possible that the missile sites may have contributed small quantities of hazardous constituents as operational information indicates JP-3 fuel, red-fuming nitric acid (RENA), aniline, hydrazine, and trichloroethylene were used

in support of missile operations. Interviews with former military personnel assigned to the area indicate that these substances were used conservatively and were not normally available in large quantities.

Limited vehicle maintenance activities may have contributed used motor oil to the landfills. Demolition wastes likely include asbestos-based materials such as transite. Environmental sampling activities conducted at the landfill locations were performed using an analogous approach. One Nike missile position (H-83), one antiaircraft position (PSN-04), and one combination Nike/antiaircraft (H-06) landfill were selected for investigation. Landfill trench locations at each of these sites were determined using magnetic and electromagnetic induction surveys. The survey areas were determined based on surface characteristics such as stressed vegetation, subsidence, and surface and partially buried debris. The results of these surveys are documented (WHC 1992b).

Areas where geophysical surveys indicated trenches and disposal sites were staked and marked. The surface of these areas were evaluated for signs of subsidence/stressed vegetation/presence of partially buried debris. Sampling locations were selected as close as possible to the center of the more significant anomalies and near areas of subsidence or stressed vegetation.

A hollow-stem auger rig was used to obtain the samples. Cuttings from the auger were screened for organic vapors at 2-ft intervals using an organic vapor monitor (OVM). Debris associated with the cuttings included wood, metal drums and cans, and transite.

Field screening was used extensively to determine the exact scope of sampling at each location. Screening samples were taken at approximately the 6- and 10-ft levels (bottom of the landfill was estimated to be 9 to 11 ft). At least one sample per anomaly was taken for analysis at an offsite laboratory.

Field screening analysis routinely included pH, heavy metals, and volatile organic compounds depending on sample characteristics (i.e., color and OVM readings). Offsite laboratory analysis included volatile and semivolatile analysis; pesticide/herbicide, and polychlorinated biphenyls (PCB) analysis; inductively coupled plasma (ICP) and atomic absorption (AA) metals (including mercury) analysis; and anions, chrome VI, total petroleum hydrocarbons, and total activity analysis.

A total of 32 samples from 45 augering locations were taken from the three landfills for analysis at offsite laboratories (Figure 2-1 and Table 2-1). This includes six samples from Nike position H-83, 16 from Nike position H-06, eight from antiaircraft position PSN-04, and six quality assurance/quality control samples. A total of 90 field screening samples were also taken during this effort (two per auger boring).

2.2.2 Drywells

Field investigations and historical drawings indicated the presence of six drywells used in support of the military positions on the North Slope. The specific uses of these dry wells could not be determined.

Figure 2-1a. Site Map with Geophysical Interpretation Site PSN-04 (North) Wahluke Slope.

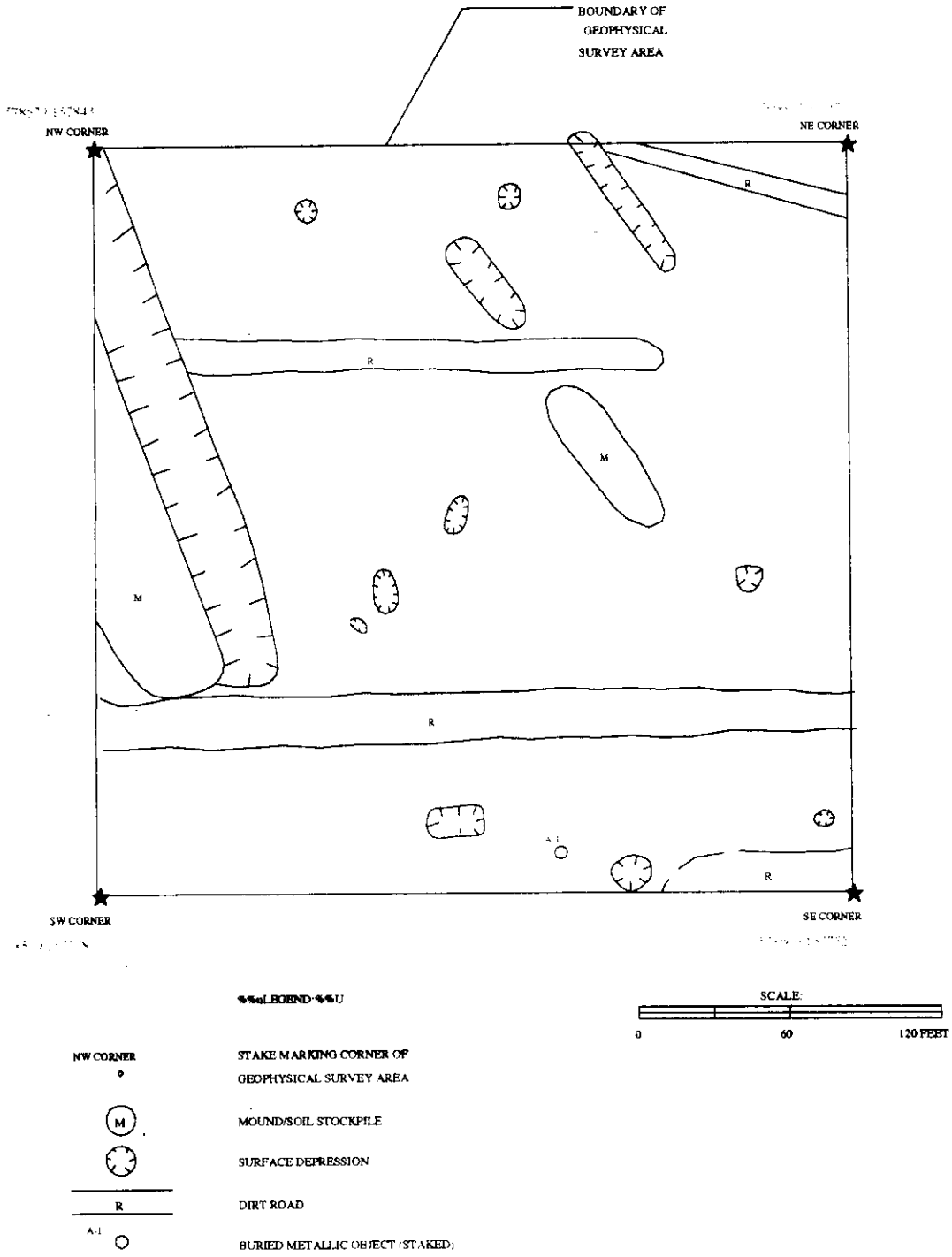


Figure 2-1b. Site Map with Geophysical Interpretation Site PSN-04 (South) Wahluke Slope.

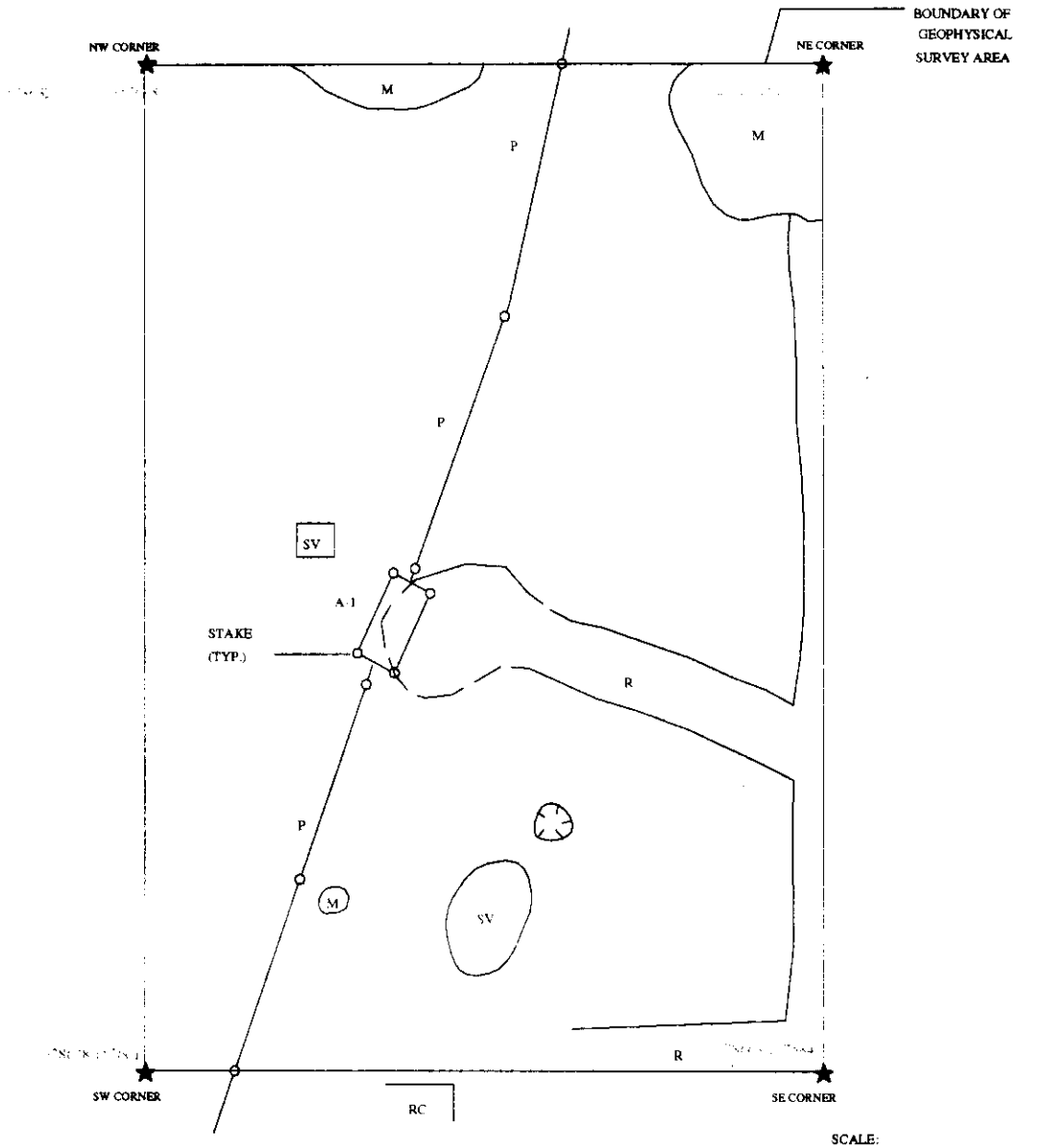


Figure 2-1c. Site Map with Geophysical Interpretation Site PSN-04 (East) Wahluke Slope.

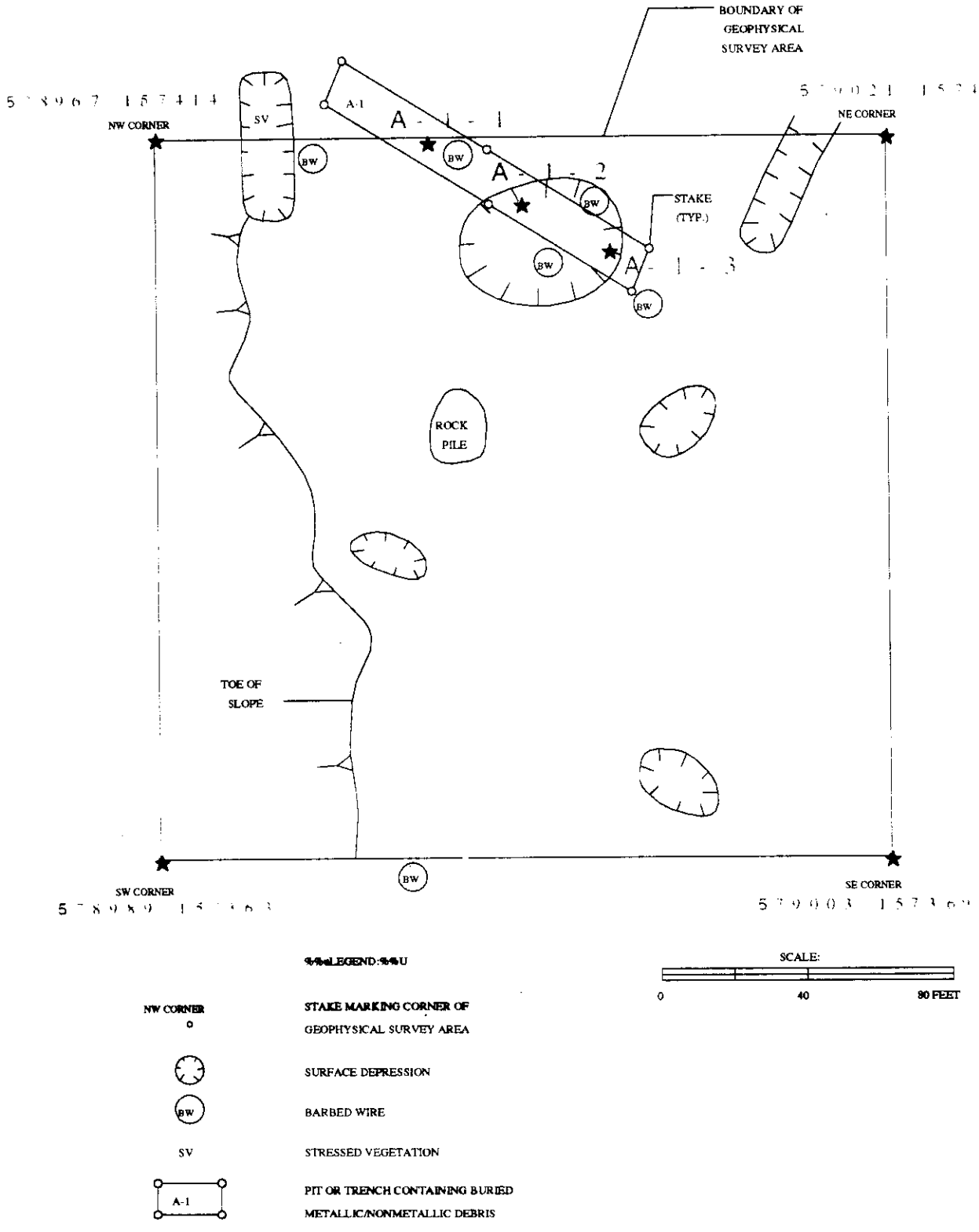


Figure 2-1d. Site Map with Geophysical Interpretation Site PSN-04 (West) Wahluke Slope.

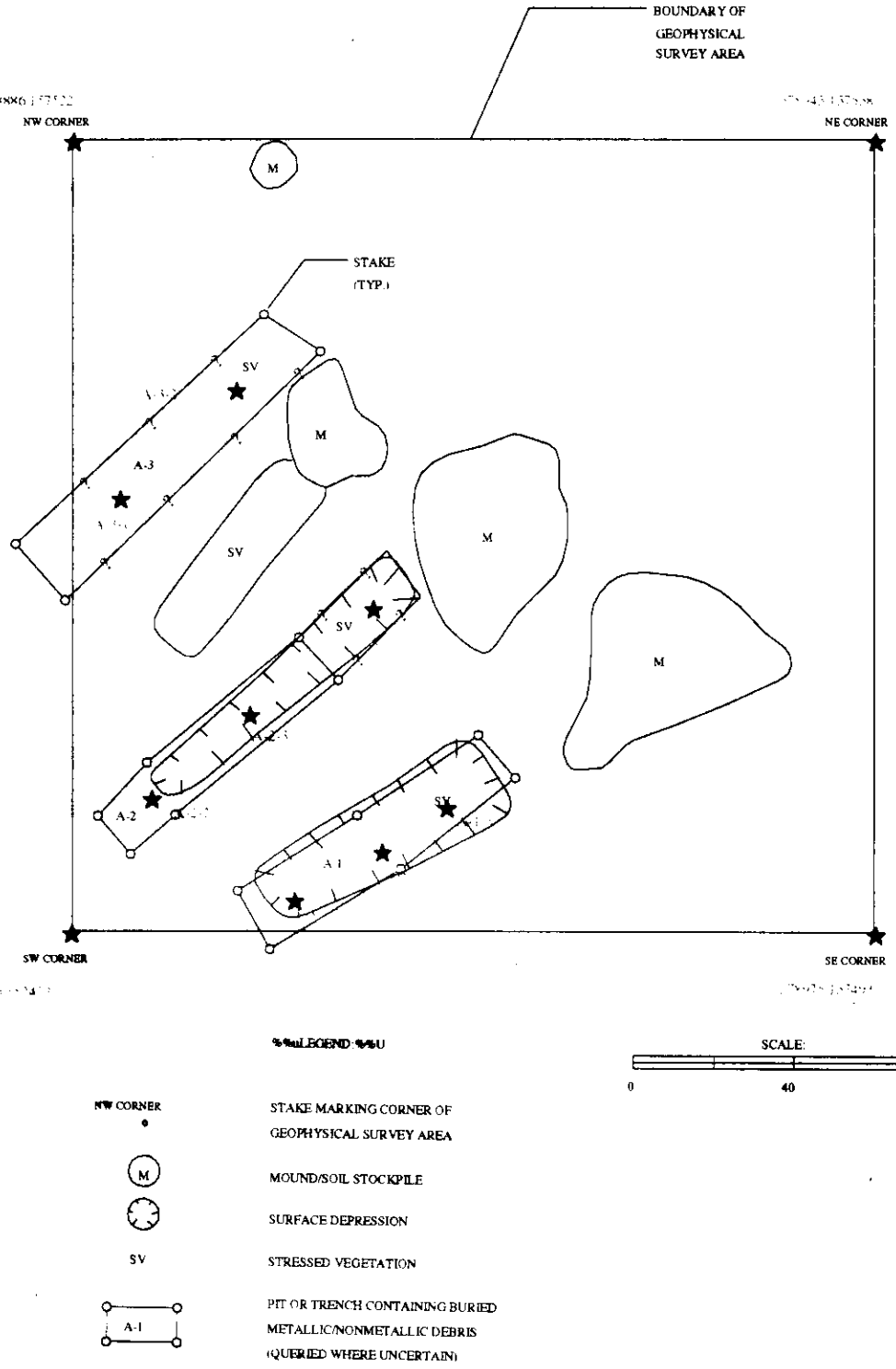
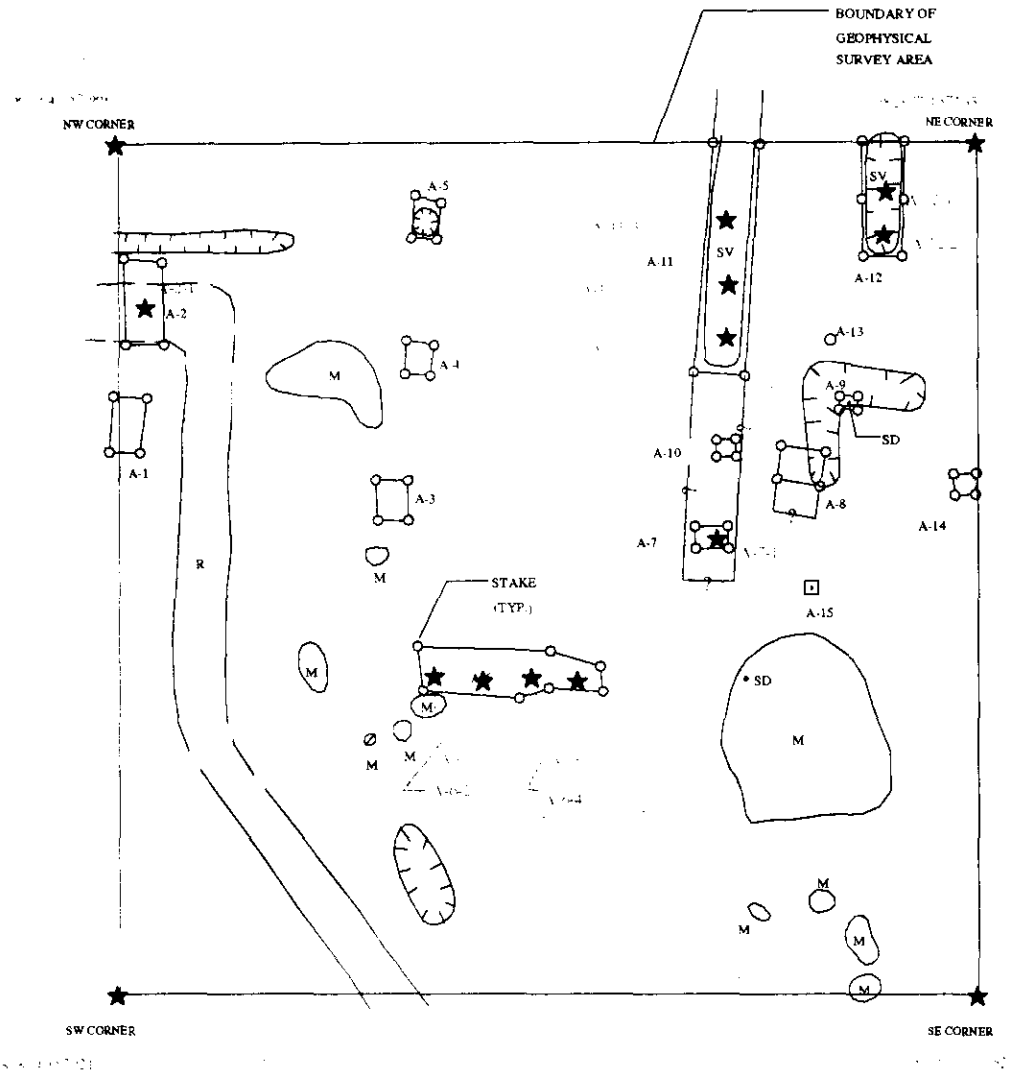


Figure 2-1e. Site Map with Geophysical Interpretation Site H-06-H (East) Wahluke Slope.



%%uLEGEND%%U

NW CORNER ◆	STAKE MARKING CORNER OF GEOPHYSICAL SURVEY AREA
(M)	MOUND/SOIL STOCKPILE
	SURFACE DEPRESSION
R	DIRT ROAD
SD	METALLIC SURFACE DEBRIS
SV	STRESSED VEGETATION
A-13 ○	BURIED METALLIC OBJECT (STAKED)
A-15 □	BURIED METALLIC OBJECT (NOT STAKED)
A-1	PIT OR TRENCH CONTAINING BURIED METALLIC/NONMETALLIC DEBRIS

Figure 2-1f. Site Map with Geophysical Interpretation Site H-06-H (West) Wahluke Slope.

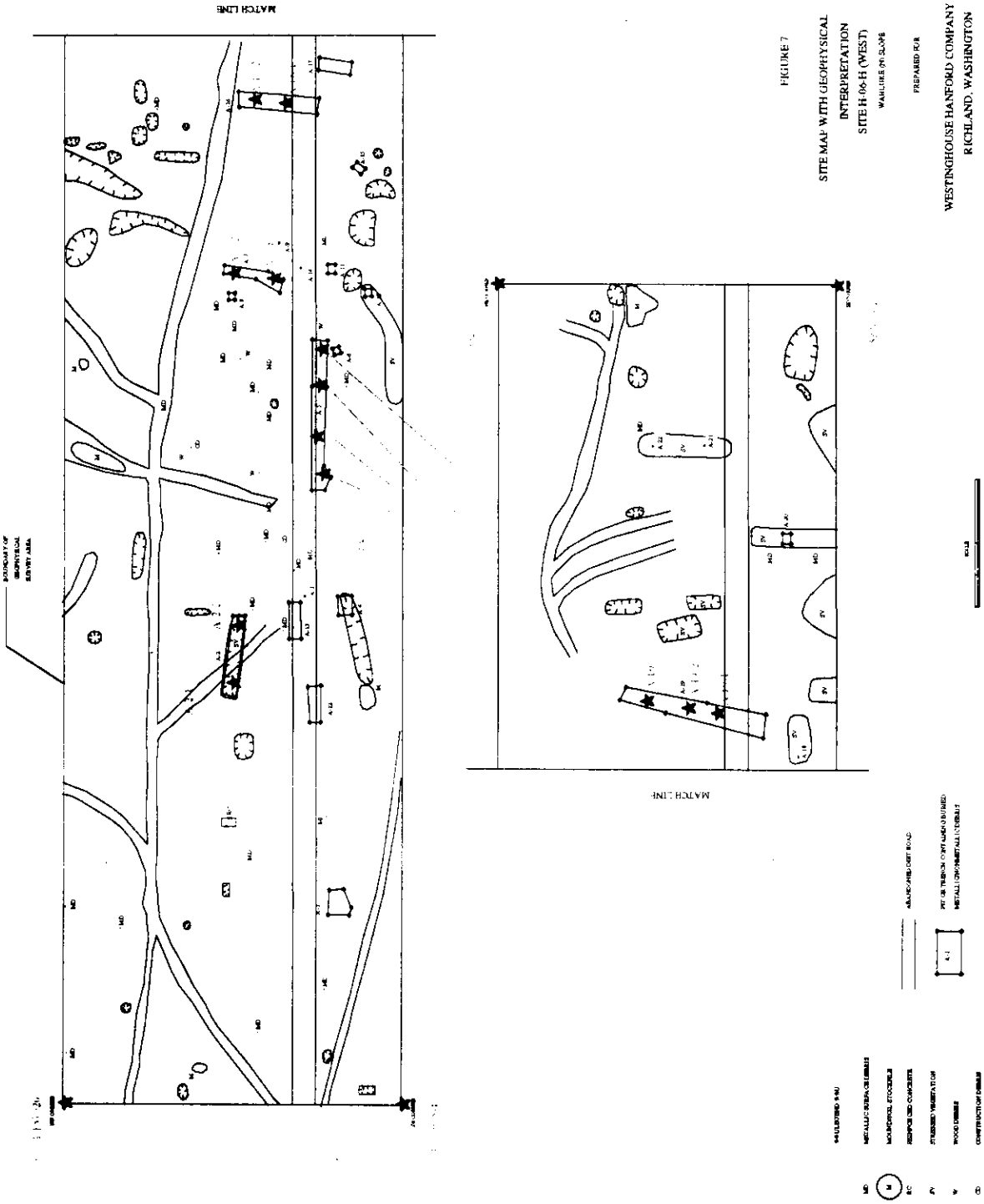


Figure 2-1g. Site Map with Geophysical Interpretation Site H-83-L Wahluke Slope.

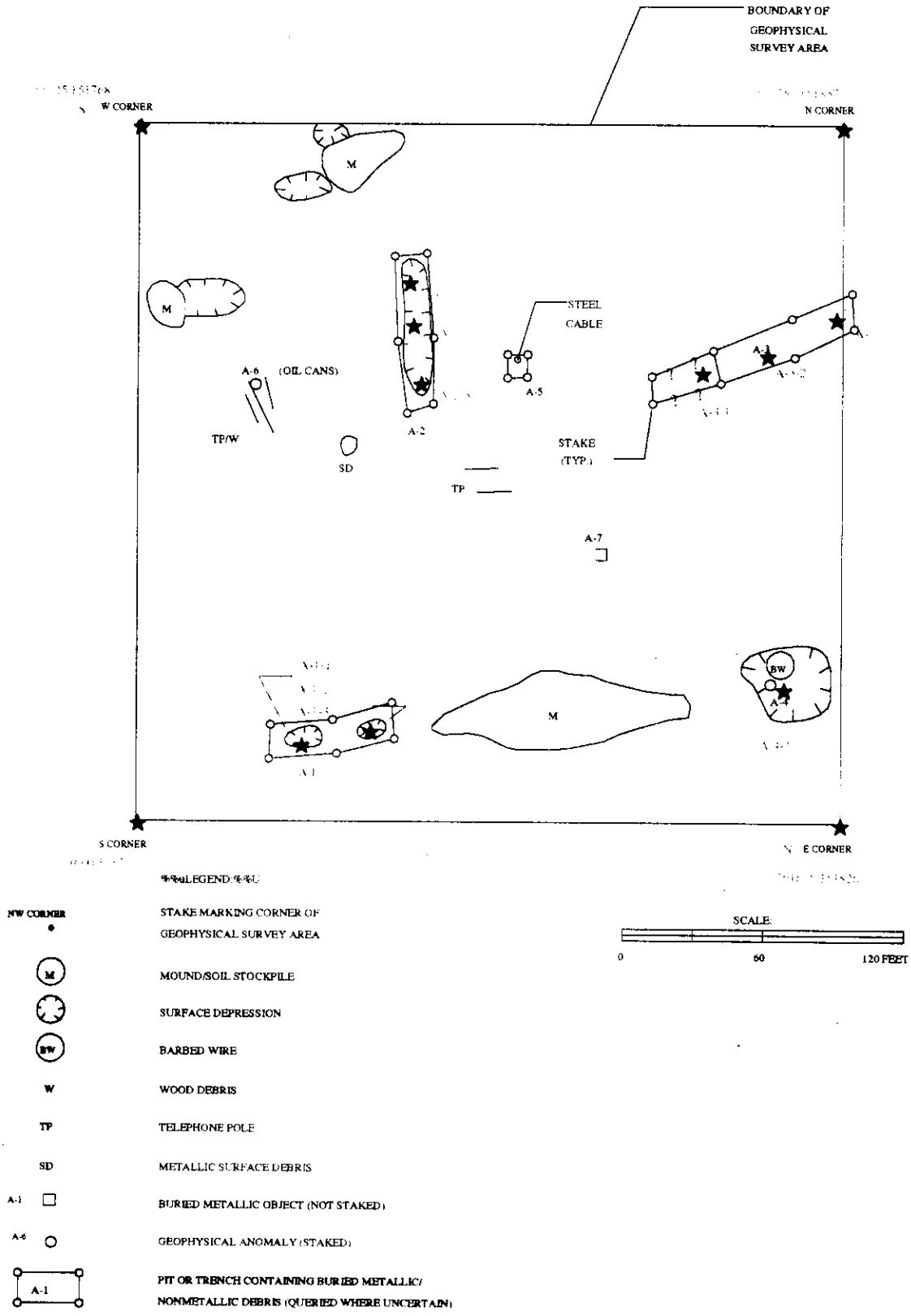


Table 2-2. Military Landfill Offsite Laboratory Sampling Summary.

Auger Sample Site	Sample Site Findings	Type of Analyses[a]
H-83-L/A-2-2	Wood fragments	SW-846
H-83-L/A-2-3	Wood debris	CLP
H-83-L/A-3-2	Wood and metal fragments	CLP
H-04(W)/A-1-2	Glass	SW-846
H-04(W)/A-1-3	Burnt wood and pieces of sheetrock	CLP
H-04(W)/A-2-3	Trash and floor tile material	CLP
H-06-H(W)/A-5-1	Wood debris, electrical and barbed wire	
H-06-H(W)/A-5-2	Wood debris and metal strapping	SW-846
H-06-H(W)/A-5-4	Electrical wire and steel cable	
H-06-H(W)/A-7-2	Burnt wood, metal, and glass	
H-06-H(W)/A-16-1	Metal drum	SW-846
H-06-H(W)/A-16-2	Communications wire	
H-06-H(W)/A-19-1	Trash	
H-06-H(W)/A-19-3	Insulated copper wire, cloth, and cinder block	CLP
H-06-H(E)/A-6-2	Metal, appeared to be an automotive part	
H-06-H(E)/A-6-3	Sheet metal	
H-06-H(E)/A-6-4	Metal debris	SW-846
H-06-H(E)/A-11-3	Glass, wire, and burnt wood	
H-81-R	Possible asphalt	CLP
H-07-H-2	Metal drum	None taken
Cow Camp Cistern	Metals, light bulbs, bottles, livestock products	
H-83-L/A-2-2	Wood fragments	SW-846
H-83-L/A-2-3	Wood debris	CLP

[a](EPA 1986, 1990a, 1990b).

Two drywells, described on a facility drawing for H-83-C, could not be located in the field. Geophysical surveys performed in the vicinity were not successful in explicitly locating the structures. They did identify two suspicious looking areas that were later investigated with a backhoe. The excavation did not reveal drywells, but rather areas with extensive demolition debris as was typical of the surrounding area.

2.2.2.1 H-81-R Drywell. This drywell is located at H-81-R, a site that was thought to contain a radar system used in conjunction with the Nike missile batteries. The drywell was constructed using a metal drum buried flush to the ground. The lid of the drum had several holes punched through it. Soil was contained inside of the drum at a depth of 2.5 ft from the top of the drum to the soil surface.

A hollow-stem auger was used to drill down the center of the drywell. At the -4-ft level, a material resembling asphalt was encountered. A sample of this material was collected for field analysis (aqueous headspace volatile organic analysis using gas chromatograph).

A split-spoon sampler was then used to collect a soil sample from the -4 to -6 ft level. Native soils were encountered approximately 5 ft below the surface. The soil sample was sent to a qualified offsite laboratory for analysis using Contract Laboratory Program (CLP) protocol (EPA 1990a,b) for volatile organics, semivolatile organics, PCB/pesticides, phosphorus pesticides, herbicides, ICP metals, AA metals (arsenic, lead, selenium, thallium), mercury, anions, chrome VI, and total petroleum hydrocarbons. A sample was also collected for determining volatile organics using EPA field analysis methods (EPA 1986).

2.2.2.2 H-06-L-1 Drywell. This drywell consists of a metal drum buried on the west perimeter of Nike missile launch site H-06-L. Soil/debris was located at 1.25 to 1.8 ft from the surface. An 8-in. diameter hole is cut into side of drum at the 4.5-in. depth.

A hollow-stem auger was used to drill inside the drum starting at the soil/debris surface. The bottom of the drum was encountered at the 3 ft level. A 6-in. diameter transite pipe was entered the side of the drum at this level. A split-spoon soil sampler was then used to collect soil from the 3- to 5-ft level. The sample consisted of 60 to 70% crushed gravel and 30 to 40% fines. The material appeared to be dry. The material was analyzed using field analysis.

A sample was then collected for analysis at a qualified offsite laboratory and using field methods from 4-in. above the bottom of drum, near the opening of the transite pipe. The soil sample collected from this site was analyzed per CLP protocol for volatile organics, semi-volatile organics, PCB/pesticides, phosphorus pesticides, herbicides, ICP metals, AA metals, mercury, anions, chrome VI, and total petroleum hydrocarbons (see table for specifics on analysis).

2.2.2.3 H-06-L-2 Drywell. This drywell is a 12- by 10- by 15-ft, rock-filled pit (as described in construction information drawings) used to route rainwater from the missile storage area at Nike missile launch site H-06-L. A 6-in. drainpipe routed liquids to drywell. At the supposed location (per drawings) of the drywell is a depression in soil.

Hollow-stem augering was performed at center of drywell site. Based on soil matrix resistance of the auger, a probable gravel layer was encountered at the 13-ft level. A field analysis soil sample and a sample for offsite analysis were taken from the 8-ft and 13.5- to 15.5-ft level.

The offsite soil sample collected from this site was analyzed per CLP protocol for volatile organics, semivolatile organics, PCB/pesticides, phosphorus pesticides, herbicides, ICP metals, AA metals, mercury, anions, chrome VI, and total petroleum hydrocarbons.

2.2.2.4 H-07-H Drywell. This drywell consists of two metal drums welded one on top of the other, buried vertically with the top almost flush with the surrounding ground surface. A 5-in. diameter pipe entered the drum at the

2.5-ft level. The pipe came from the direction of what drawings indicate was a wash rack associated with a vehicle repair shop at Nike launch site H-07-H. The depth from the top of the drywell to soil was approximately 3.8 ft. Originally, this site was to be investigated using a hollow-stem auger and split-spoon sampler. During angering, river cobble was encountered at the 1-ft level that eventually prevented further operation of the auger. It was decided to utilize a backhoe to excavate the drywell and sample at the cobble/soil interface.

During excavation of this drywell, another 5-in. diameter pipe, buried approximately 2.5 ft deep was uncovered. This pipe was not connected to the to the drywell, but ran in-line with the pipe that was connected to the drywell. The end of this pipe was located 7 ft from the actual drywell in the cobble material. A third pipe was uncovered that ran north northeast/south southeast. Again, this pipe was not connected to the drywell but ended with the cobble material about 5 ft from the side of the drums.

The drywell was excavated down to a depth of 16 ft, where the soil/cobble interface was located. A soil sample was collected from the backhoe bucket for field analysis. A sample was also collected for analysis at an offsite laboratory per CLP protocol for volatile organics, semivolatile organics, PCB/pesticides, phosphorus pesticides, herbicides, ICP metals, AA metals, mercury, anions, chrome VI, and total petroleum hydrocarbons. The drywell and attached metal pipe were removed from the excavation.

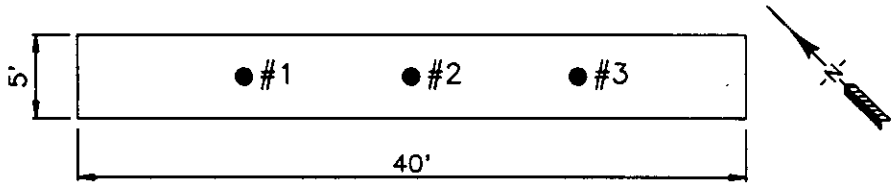
2.2.3 Acid Neutralization Pit

These structures, located at the Nike missile launch sites, were used to dispose of soda solutions used to neutralize residual RFNA contained in hoses used in missile fueling/defueling operations. The pits would also receive any RFNA spilled during these activities. Historical interviews indicate that no spills were known to have occurred, and the neutralization pit was not used for disposal purposes.

Using the analogous site approach, only one pit was investigated. Facility drawings for the Nike sites were used to locate the pits. One pit was identified at each Nike missile position. Field investigations were unable to locate the pit at Nike missile position H-06-L however. A pit was located and, consequently, investigated at position H-12-L.

The pit is 5 ft wide by 40 ft long and constructed into a 1-ft-thick concrete pad located in the missile fueling area. Field investigations indicated the pit was excavated to a depth of approximately 4 ft and backfilled with pea gravel. A backhoe was used to investigate three locations along the length of the pit. The samples were taken within the pit at the native soil (sand/silt) and pea gravel interface. A map of the sample locations are provided in Figure 2-2. The samples were field screened for pH. The pH of samples 1 and 2 was approximately 6.5, while sample 3 was 5.9 to 6.2. Soil samples taken from locations 2 and 3 were sent for analysis at a offsite laboratory. The offsite soil samples were analyzed one per CLP (EPA 1990a,b) and one per RCRA (EPA 1986) protocol for ICP/AA metals and anions.

Figure 2-2. H-12-L Acid Neutralization Pit (Overhead View of Sample Locations).



2.2.4 Unexploded Ordnance

The use of small caliber and large caliber ordnance was routine for the Nike missile and antiaircraft gun emplacements. Unexploded ordnance may be present on the North Slope as not all rounds of ammunition would fire properly. Interviews with former military personnel assigned to these posts indicate that unused, antiaircraft shells may have been disposed of in remote burial trenches. Other personnel, however, indicated that this disposal practice was very unlikely.

Ordnance experts investigated three sites on the North Slope as a result of the initial site survey. These sites are designated PSN 07/10, Shrapnel Area, and Hanford Firing Range. No unexploded ordnance was located.

2.2.5 2,4-D Disposal Site

The 2,4-D burial site is located approximately 0.5 mi east of the Columbia River across from and south of the old White Bluffs townsite at the toe of an encroaching sand dune, which is over 60 ft in height. The disposal area is approximately 400 by 60 ft in size and is posted on the northern and southern ends of the landfill. The signs read "2,4-D Burial Site, June 1966." The site is approximately 700 ft above sea level (350 ft above the Columbia River). Groundwater is over 300 ft below grade with the nearest drinking water located over 3 mi to the east.

The site was used in 1966 to dispose of 2,4-D-contaminated soil generated from leaking storage tanks located at a U.S. Bureau of Reclamation Station in Eltopia, Washington. The leaking tanks were flattened and disposed of at the site in 1967. 2,4-D was used as a commercial herbicide. 2,4-D is one of the only herbicides that is able to be metabolized by bacteria. The breakdown takes approximately 30 days. Additional information indicates a typical 2,4-D half life of 9.4 to 254 days under dry conditions (Howard 1991). The area was not used for 2,4-D disposal after 1967. The sand dune and disposal site have since stabilized with cheatgrass and sage.

The Waste Information Data System (WIDS) database (WHC 1991) indicates that approximately 50 yds^3 of soil containing 900 gal of 2,4-D were disposed of at the site (a relatively small volume of soil when compared with the areal extent of the site), 4 ft below grade. Discussions with personnel from the U.S. Bureau of Reclamation indicate that the 2,4-D tanks were disposed of over the 2,4-D contaminated soil. This would indicate that the soil was buried significantly deeper than the 4 ft indicated in WIDS. Therefore, there should be no traces of the herbicide remaining as the 2,4-D was disposed of over

18 yr ago. Studies indicate little tendency for 2,4-D to bioconcentrate in aquatic organisms and that food chain contamination should not occur.

Prior to performing sampling activities, a metal detector was used to verify the presence and location of the tanks disposed of at the site.

An auger rig was used to obtain soil samples from eight locations within the boundaries of the disposal site (Figure 2-3). Auger cuttings were predominantly a fine sand typical of the surrounding geology. Drilling indicated that the disturbed material-native material interface is at approximately 13 to 15 ft below the surface. A readily evident soil moisture horizon was located 3 to 5 ft below grade.

Samples were obtained from the 13- to 15-ft depths at each of these locations using a split-tube sampler. Each sample set consisted of a 60-mL amber glass bottle for total activity analysis, a 250-mL amber glass bottle for offsite laboratory analysis (if required), and a field screening sample. The 250-mL sample was sent offsite for analysis only if field screening indicated the presence of 2,4-D. Two composite samples, composed of soils from the 250-mL bottles, would be sent offsite for analysis from locations in which field screening did not detect 2,4-D.

A 2,4-D field screening test kit was used to analyze for 2,4-D at each of the sampling locations. The results of this test indicated the presence of 2,4-D at sampling location #8. The test indicated the presence of 2,4-D at approximately 2 ppm, which is near the detection limit of the field test kit. However, 2,4-D was not detected in subsequent field runs of the analysis. A sample from this location was sent to an offsite laboratory for confirmatory analysis under CLP protocol.

An additional field screening sample was taken at location #7 from the 6-ft level as clay "globules" were seen in the cuttings. Field analysis did not indicate the presence of 2,4-D. Two composite samples (one consisting of soils from locations 1, 2, 3, and 4 and one from locations 5, 6, and 7) were also sent for analysis at an offsite laboratory.

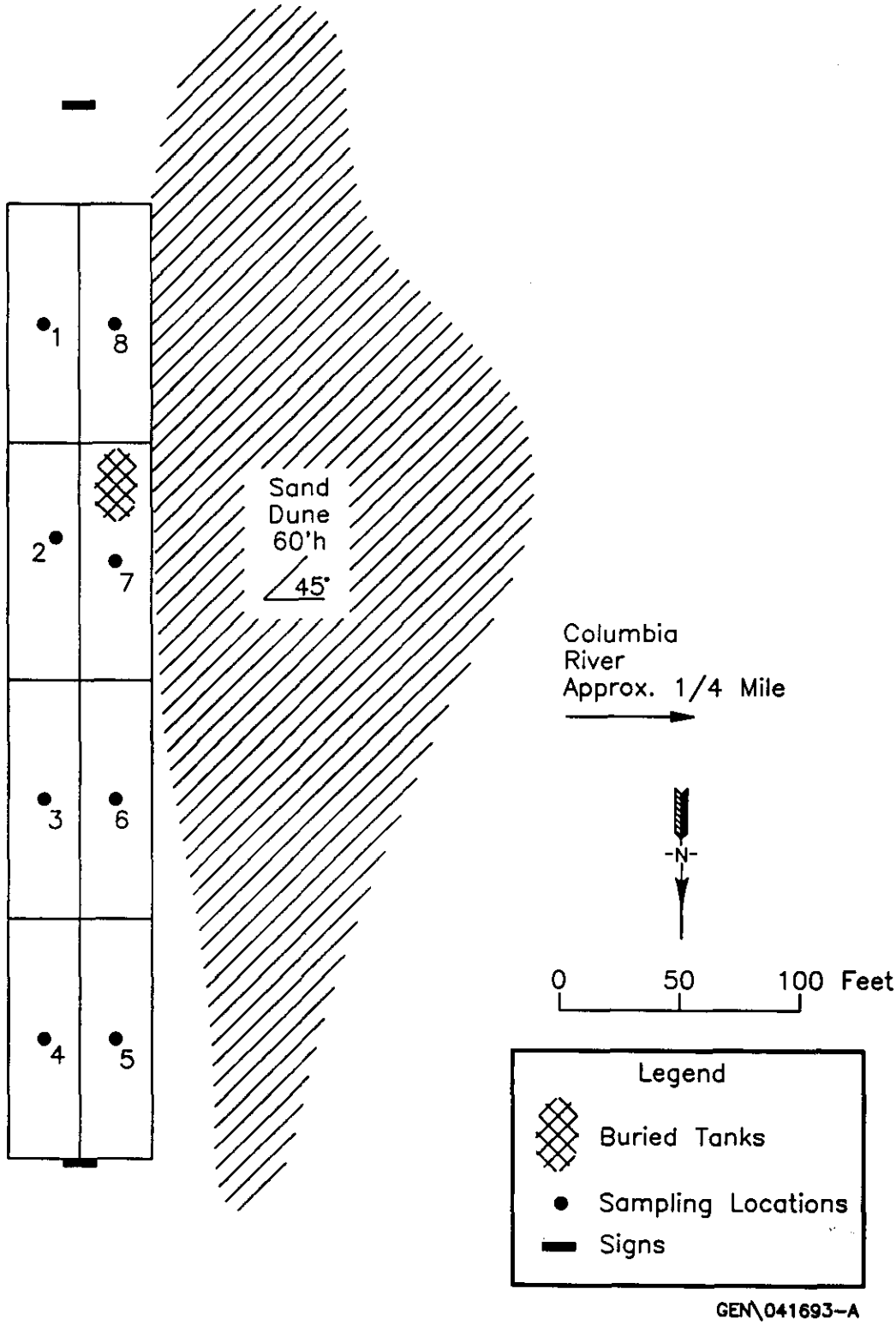
2.3 CONCRETE GREASE RACK

A concrete ramp, originally constructed for maintenance of military vehicles was dismantled during site investigation activities. The ramp, located at antiaircraft site PSN-90, was being utilized by the public for performing oil changes on their vehicles. As a result, used motor oil was disposed on the ground beneath the ramp.

An area approximately 15 by 24 ft of obviously contaminated soil was excavated to a depth ranging from 0 to 8 in. The contaminated soil was placed into five plastic lined 55-gal drums. Additional contaminated material was placed onto a sheet of plastic.

Samples were taken from the bottom of the excavation, from the drummed material, and from just outside of the excavation boundary. Field analyses for volatile organics using gas chromatograph and for total petroleum hydrocarbons (using immunoassay kit) were performed on these samples.

Figure 2-3. 2-4,D Burial Ground Sampling Location.



The immunoassay kit results are as follows:

- drummed material - 100 to 1000 ppm
- bottom of excavation - < 100 ppm
- outside of excavation - < 100 ppm
- composite sample from excavation - > 100 ppm.

Two representative samples were collected from the drums for waste designation using SW-846 protocol for total petroleum hydrocarbons and ICP/AA metals. Two additional soil samples were collected from the scraped area for offsite analysis for total petroleum hydrocarbons, and ICP/AA metals per EPA protocols (1986, 1990a,b).

2.4 HOMESTEAD CISTERNS

Significant amounts of soil and debris are located in the bottom of the seven cisterns located on the North Slope. The possibility exits that the pits may have been used in the disposal of pesticides or oil as empty product containers can be found in several of the cisterns. Due to the remote locations of the cisterns, the disposal of significant quantities is unlikely. Three of the cistern exhibiting the greatest potential for having contamination were characterized. A visual inspection of the remaining four cisterns was also completed.

2.4.1 Clay Pit Cistern

The clay pit cistern is a circular, concrete-lined pit located north east of Nike position H-06-L (see Figure 1-2). The cistern was filled with water due to melted snow. This site was investigated because of the presence of pesticide and oil containers. The cistern is approximately 5 ft 6 in. deep by 5 ft in width. The water was within 1 ft 6 in. from the top with sediments located 1 ft below the water surface.

Utilizing a hand bucket auger, an attempt to collect a sediment sample was made. The sample material could not be retained in the auger due to the slurry composition of the sediments being sampled. An attempt was made several times to collect sufficient material for an offsite soil sample, but was unsuccessful. Enough soil was collected for field analysis. The trash removed from the cistern included transmission oil cans, oil cans, cattle pesticide containers, beverage containers, aerosol cans, coffee cans, food cans, and an oil filter.

2.4.2 Cow Camp Cistern

This cistern is approximately 4 ft 8 in. in diameter. The depth of the cistern could not be determined due to extensive amounts of debris located 2 ft below the top. The cistern was characterized because of the presence of large quantities of debris including rusted metal, light bulbs, beverage bottles, livestock pesticide containers, electrical components, wood, and food containers.

A shovel was used to attempt to remove the debris so a soil sample could be obtained. The trash continued to a level below the reach of the shovel however. No soil could be collected for analysis at an offsite laboratory. A small volume of soil containing small pieces of rusted metal was collected for field screening analysis.

2.4.3 Homestead Cistern

The homestead cistern is approximately 5 ft 6 in. across. Soil and debris are located approximately 4 ft below the surface. The debris in the bottom of the cistern appears to be homestead-associated food containers.

A hand auger was used to collect a sample of the cistern sediments at two colocated spots. The sample was sent to an offsite laboratory for analysis per CLP protocol.

Analytes included semivolatile organics, PCB/pesticides, phosphorus pesticides, herbicides, ICP metals, AA metals, mercury, anions, chrome VI, and total petroleum hydrocarbons. No offsite volatile analysis was performed because field analysis for volatile organics was negative.

2.4.4 Stock Tank and Well/Wagon Road Cistern/ 12-3 Cistern/Overlook Cistern

These four homestead sites were each inspected for potential environmental hazards. The cistern bottoms were relatively free of debris with the exception of wood. No unusual discolorations were noted. No identifiable environmental hazards were observed. Therefore, soil sampling was not warranted.

3.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 7.5 of the Action Plan Tri-Party Agreement (Ecology et al. 1989) contains the basic description of applicable or relevant and appropriate requirements (ARAR).

There are no applicable federal cleanup standards or chemical-specific ARAR for compounds in soil (hazardous or radioactive) except the EPA standards for lead and radium. The potential cleanup standards for the North Slope ERA have been developed using the Model Toxics Control Act (MTCA) (WAC 173-340).

4.0 SAMPLING DATA

Contaminants of concern for the North Slope sampling efforts were based on operational processes utilized at Nike missile and antiaircraft gun emplacements. These analysis included volatile and semivolatile organics, metals, anion, and total petroleum hydrocarbons. Herbicide and pesticide

analysis was also included as these substances were routinely used by both homesteaders and the military.

The results of this sampling effort are provided in Appendix A.

Numerous field screening analysis were also performed. The individual results are documented in the field log book. The results of the VOA field screening analysis are provided in Appendix B.

4.1 DATA VALIDATION

The data packages were verified for required laboratory deliverables associated with the analysis performed. All CLP protocol sample analysis are being validated using WHC procedures (WHC 1992c).

4.2 DATA ASSESSMENT

The data obtained from sample analyses were compared to the action levels for residential soils in accordance with Method A of the MTCA (WAC 173-340, Section 740). These action levels were selected to accommodate proposed unrestricted land use for the North Slope. After comparison, the only analytes exceeding action levels were total petroleum hydrocarbons and lead. The sample sites and sample concentrations associated with these analytes are located in Table 4-1.

Table 4-1. Contaminants of Concern.

Sample No.	Location	Analyte	Concentration (ppm)	MTCA Method A Action Levels (ppm)	Comments
B07KR9	H-90	Lead	1,200	250	Oil site waste drum
B07KS0	H-90	Lead	760	250	Oil site waste drum
B07KQ1	H-81-R	TPH	910	100	Dry well
B07KR9	H-90	TPH	60,000	100	Oil site waste drum
B07KS0	H-90	TPH	65,000	100	Oil site waste drum
B07SK1	H-90	TPH	940	100	Oil site scraped area
B07SK2	H-90	TPH	1,700	100	Oil site scraped area

Not all of the identified analytes were listed under the residential soil action levels. Identified sampling analytes not listed under the residential soil action levels were compared to the maxima and 95/95 reference threshold levels for sitewide soil background as listed (DOE-RL 1993). No sample analytes were identified that differed significantly from background results. Strontium and phosphorous did not have background values identified. A background value (world mean value in soil - 280 ppm) for strontium was identified on page 65, Table 4.7, of "Heavy Metals in Soils," edited by B.J. Alloway, Blackie-Glasgow and London, Halstead Press-John Wiley & Sons, Inc., New York, 1990. Sample data concentrations fell below this average level. A background value (200 to 5,000 ppm) for phosphorous was identified on

Exhibit 16-2, "The Content of Various Elements in Soils", on page 16-6 of EPA document, "A Compendium of Superfund Field Operations Methods," OSWER Directive 9355.0-14, December 1987. Sample data concentrations for phosphorous fell within this range.

The semivolatile and volatile organic sample analytes identified were all <1 ppm, and are common plasticizers and laboratory contaminants. Identified herbicides/pesticides (including phosphorous-based) concentrations were all <1 ppm or were laboratory blank contamination. These analytes are indicative of spraying residue because of widespread occurrence at these low concentra-tions. No risk assessment was determined necessary for these analytes.

5.0 RESPONSE ACTIONS ALTERNATIVES

Potential response action alternatives were developed based on hazards identified during site investigation activities and potential future land uses. Potential land use categories include:

- No Action - Retain the area as a wildlife refuge/wildlife management area under DOE ownership.
- National Wildlife Refuge - Transfer the property to the U.S. Fish and Wildlife Service, who would manage the property as a wildlife refuge.
- Unrestricted Land Use - Make the area available for unrestricted use. This would allow the property to be developed under private ownership. Potential land uses under this category would include agriculture and residential development.

The No Action and National Wildlife Refuge categories are included in the draft environmental impact statement (EIS) for the Hanford Reach of the Columbia River. North Slope area has been included in the U.S. Fish and Wildlife Service's Land Acquisition Priority System and was ranked first of 187 proposed refuge projects as of September 23, 1992.

The Unrestricted Land Use category was not considered in the draft EIS. Information from the Bureau of Reclamation, Columbia Basin Project Office, who manages the Columbia Basin Irrigation District (which includes the North Slope area), indicates that the North Slope area is not planned for future development.

The Bureau of Reclamation also indicated that while no detailed cost estimate has been prepared, development of the area would require expansion of existing canals, which would be costly due to the geological formation (basalt) through which they run. The Bureau of Reclamation speculated that development costs would exceed land values. Also, based on studies in the early 1970's, the Bureau of Reclamation determined that irrigation would increase the potential for landslide activity along the White Bluffs.

5.1 NO-ACTION

Under this alternative, no additional field activities would be performed. Remedial actions, if required, would be examined under the remedial investigation/feasibility study process for which no start date has been established for the North Slope.

5.2 HAZARD MITIGATION

This alternative, if implemented, would remove/minimize the physical hazards present on the North Slope.

This alternative would include backfilling depressions and stabilizing landfills. This would reduce the potential for future subsidence and exposure of buried debris.

A haul truck and front-end loader operation would be used in performing the stabilization activities. Fill material from a local source would be brought on the site and put in place with a front-end loader. The bucket from the front-end loader would then be used to compact the material. If the area is extensive, it may be revegetated with native grasses. (It may be necessary to postpone the revegetation activities depending on the time of year.)

These activities would include the backfilling to grade of the underground structure located at PSN-90 and the numerous cisterns and subsidence areas associated with all the military sites (including landfill areas), removal of surface debris left by the military, and an ordnance survey/cleanup effort. Concrete rubble material would be left as it provides habitat cover.

A semiannual survey of the area would be performed to identify any further subsidence or physical hazards associated with the sites. Mitigation of these hazards would be handled by the site landlord.

The petroleum-contaminated soil associated with the concrete grease rack and the drywell located at military position H-81-R would be removed and disposed of according to current site procedures. An estimated 110 ft^3 (15 55-gal drums) of contaminated soil would be removed.

The ordnance survey/cleanup effort would be performed by the U.S. Army Corp of Engineers and will include the following tasks.

1. Archive search and ordnance and explosive waste modeling.
2. Prioritize parcels for study.
3. Limited site investigation (LSI).
4. LSI report.

The ordnance survey may identify additional landfill/disposal areas requiring stabilization. The location of the known waste sites will be recorded and documented on deeds for the area.

An evaluation of the wells would also be made. The evaluation would determine the condition of each of the wells and determine if the structure should be remediated or abandoned in accordance with state requirements. It is assumed for the purposes of this evaluation that the wells will be abandoned.

A flora and fauna survey would be performed in each area where ground disturbance will occur. This will assure the impacts to potential endangered or threatened environmental species would be minimized.

This alternative would be protective of the public and environment for both the National Wildlife Refuge scenario and No Action land use scenario since access by unauthorized personnel into disposal areas would be restricted by either the DOE or the U.S. Fish and Wildlife Service.

5.3 WASTE REMOVAL

The contents of all identified disposal areas would be removed under this alternative. The activities identified in the hazard mitigation alternative would also be performed. The following description does not account for the demolition debris located at the military positions. The removal of this material would be a simple expansion of the work described below.

Due to the limited knowledge about the configuration of these sites, some assumptions must be made to complete a basis for planning the waste removal.

It is assumed that each of these landfill areas is covered with a 5-ft layer overburden on a 5-ft-thick layer of debris and soil mixed. While the landfill areas will vary from location to location, it is assumed that each antiaircraft site covers 3 acres and each Nike missile site covers 5 acres. Actual disposal area at each of these sites is considered to be 50% of the total landfill area. Of the 10 sites, seven are antiaircraft and three are Nike.

The excavation and removal of the waste at these sites will be performed at each of the 10 sites. A mobile office and change and lunch facilities will be staged at the removal site. Necessary equipment and trucks will also be staged. Excavated material will be disposed of at the Central Landfill Facility located south of 200 East Area.

Large volumes of water for dust control will be a necessity for all locations. Assuming permission is granted, water will be obtained from two irrigation wasteways. The Saddle Mountain Wasteway can provide the western five sites and the Wahluke Wasteway, Branch 10, can provide the eastern five sites. If the waste removal cannot be completed during the irrigation season, it may be possible to withdraw water from the Columbia River. River access is possible; however, the haul distances are longer.

Once the equipment is set up, hand labor will begin clearing surface debris from the landfill. As soon as enough of the surface debris has been cleared, the overburden will be pushed to the side with a bulldozer. The

exposed waste will then be placed by front-loader into the waiting 20-yd^3 dump trucks and hauled to the CLF.

The waste will be covered with tarps for transport unless it is transite or asbestos bearing. It is assumed that asbestos- or transite-bearing waste will only be a 1% of the total waste. The waste will be transported in plastic-lined and covered trucks with appropriate markings. This waste is disposed of in special trenches at Central Landfill Facility.

As the waste loading operation progresses, the overburden adjacent to the cleaned areas will be pushed back into the excavation and the area recontoured with the surrounding terrain. When waste removal is complete at each location, the trailers and equipment will be demobilized and restaged at the next site. Revegetation will be performed during the appropriate season.

6.0 EVALUATION OF REMEDIAL ALTERNATIVES

Selection of the preferred alternative is a two-phased process. The initial alternative screening phase (first phase) eliminates those alternatives that will not meet the goal or intent of the ERA. The second phase, detailed alternative evaluation, evaluates each alternative with respect to timeliness, protection of human health (including the pubic and those performing the work) and the environment, effectiveness, and cost is initial screening of potential cleanup activities against the criteria of timeliness and environmental protection. The second phase rates a preferred ERA performance method.

Each of the alternatives was evaluated to determine if it met the goal of the ERA. The alternative must take the steps necessary to protect human health and the environment from potential exposure to hazardous substances. Alternatives considered for further evaluation must also minimize the physical hazards identified in the previous sections. The level to which these hazards will be addressed is dependent on future land use. Potential land uses identified include agriculture and residential uses or management as a federal wildlife refuge or wildlife management area.

If the area is transferred to the U.S. Fish and Wildlife Service to be maintained as a wildlife refuge/management area, any activities occurring on the property would be strictly monitored and controlled by the U.S. Fish and Wildlife Service in support of this land use. Public access would most likely be allowed in some portions of the area. Their activities would be limited to recreational uses of the property such as hunting and fishing. No construction nor excavation type activities are anticipated.

If the area is made available for unrestricted land use, the area will likely be used for both agricultural and residential purposes. Under this scenario, activities occurring on the property would not be controlled by a central agency. Each landowner would have the ability to manage the property within the limits of state and federal laws. Restrictions could be incorporated into the property deeds in attempt to control activities, though this is not considered a viable option as potential liabilities would remain with

the DOE. The following describes the screening evaluations made on each of the alternatives.

6.1 NO-ACTION

Under the No-Action alternative, no attempts to remediate identified hazards would be made. Based on the results of the environmental sampling effort, the potential for environmentally damaging consequences including human exposure to potentially hazardous substances is considered to be negligible. The likelihood for physical injury is possible but not probable. There has been no reported injuries associated with the North Slope sites to date. This alternative does not meet the goal of the ERA, which includes minimizing the presence of physical hazards to both the public and Hanford employees. This alternative will not be considered further.

6.2 HAZARD MITIGATION

This alternative would include both minimization of physical hazards and cleanup of the oil-contaminated soils associated with the grease rack and drywell. It would therefore minimize the potential for human exposure to potentially hazardous substances and reduce the risk of injury due to the physical hazards present. It would minimize the potential for exposure to asbestos-regulated materials of the wildlife refuge/management land use scenario. This alternative meets the goal of the ERA and would be sufficient for the wildlife/refuge land use scenario. Implementation of this alternative would not be supportive of the unrestricted land use scenario. This alternative will be retained for further evaluation.

6.3 HAZARD REMOVAL

This alternative would include both minimization of physical hazards and removal of material within the landfills and oil-contaminated soils associated with the grease rack and drywell. While removal of the materials in the landfills would reduce the risk of exposure to the public of asbestos materials, a substantial volume of this material would remain with the buried demolition debris located at the military sites. This material would also require removal to minimize the potential for human exposure to asbestos-regulated materials.

Implementation of this alternative would meet the goal of the ERA and would be supportive of the wildlife/refuge land use scenario. If the demolition debris is also removed, this alternative would support all identified land use scenarios. This alternative will be retained for further evaluation.

7.0 ALTERNATIVE EVALUATIONS

Two of the three alternatives were retained for further evaluation. These are Hazard Mitigation and Hazard Removal. These alternatives were evaluated based on how well the alternative protected human health and the environment. This includes both exposures resulting from implementation of

the alternative and once implementation is complete. Specific evaluation criteria include environmental impacts, managerial feasibility and cost.

The environmental impact criterion considers the anticipated/potential effects each of the alternatives may have on human health and the environment. This includes impacts seen during implementation and over the long term, after implementation is complete.

Managerial feasibility focuses on the ability to perform the activity and includes availability of equipment and the necessary labor forces and required permits.

The cost for implementing each of the alternatives must also be considered in selection of the preferred alternative. While protection of human health and the environment is the primary concern, the cost associated with implementing the alternative may determine the appropriate alternative when environmental considerations between the various alternative are equal. A summary of the evaluation and associated screening criteria are provided in Table 7-1.

Table 7-1. Alternative Evaluation Summary.

Criterion	Hazard Mitigation Alternative	Waste Removal Alternative
Protection of Human Health	Alternative would adequately protect human health if area remains a wildlife refuge/management area. Risks may increase if area released for unrestricted use.	Alternative would be protective of human health regardless of future land use.
Timeliness	Activities could be completed by end of FY 1993.	Activities could be completed by end of FY 1994
Environmental Impacts	Impacts would be minimal. Activities may temporarily stress small areas of vegetation.	Impact would be minimal. Activities may temporarily stress large areas of vegetation.
Reliability	Proven technology.	Proven technology.
Managerial Feasibility	Activities would be easily implemented.	Activities would require identifying additional non-Hanford resources for implementation.
Cost	$1,897,500	$21,173,000

7.1 PROTECTION OF HUMAN HEALTH ENVIRONMEN EVALUATION

As stated previously, the level to which the alternatives will protect human health is dependent on what the property will be used for. Each of the alternatives equally addresses mitigation of the physical hazards. The primary difference is that the hazard mitigation alternative proposes stabilization of the landfill areas as opposed to removal of the landfills. The primary hazard identified at these landfills is the presence of asbestos and asbestos-based materials.

If the landfills are stabilized, having all exposed material (surface debris) removed as proposed by both alternatives, there is a relatively minor chance for exposure to the public of the asbestos-based materials contained in the landfills if the land is maintained as a wildlife refuge. The probability increases if the property is made available for development. Potential exposures to the workers implementing this alternative are negligible.

If the contents of the landfills are removed, the potential for public exposure in the long term is reduced for all land use scenarios. This risk would be further reduced if the demolition debris is removed from the military sites. If the land is to be made available for unrestricted land use, then this material would also require removal.

Excavation of these materials requires extensive controls to ensure the asbestos materials do not become airborne. The potential for worker and public exposures to the asbestos materials during the removal activities does exist and should be considered a potential environmental impact.

7.2 MANAGERIAL FEASIBILITY

The tasks required for implementing each of the alternative are considered to be routine by industry today. The primary difference between the two alternatives is the removal of the landfills and demolition debris versus stabilization of these areas. While both alternatives are technically feasible, the removal actions require considerably more resources, including equipment and labor for completion.

The hazard removal alternative will require the leasing of heavy equipment and the labor force to run it. The resources necessary for performing these activities would not be available onsite. Additional landfill space at the Central Landfill Facility would also have to be created.

The resources necessary for performing the stabilization activities would be available onsite and would not require additional leasing or purchasing of equipment.

7.3 ACTIVITY SPECIFIC COST ESTIMATES

The cost for performing each of the activities associated with each of the ERA alternatives is provided in Appendix D. A 25% contingency included in the estimate. These costs estimates are for comparative purposes only. No overheads nor organizational adders were included. Table 7-2 summarizes the costs associated with performing each alternative.

Table 7-2. Alternative Cost Estimate Summaries.

Alternative	Cost, $
Hazard Mitigation	1,897,500
Hazard Removal	11,520,000
Hazard Removal (including demolition debris)	21,173,000

8.0 PREFERRED REMEDIAL ALTERNATIVE

The selection of the preferred alternative requires that a land use scenario be chosen for the area. It is assumed, based on the U.S. Fish and Wildlife Service's listing the area as its number one priority in land acquisitions for future wildlife refuge areas, that the property will be made into a wildlife refuge.

Both of the alternatives are adequate for protection of human health and the environment if the wildlife refuge land use scenario is enacted. The selection of the preferred alternative is then dependent on cost and managerial feasibility. Both alternative are feasible; however, the Hazard Removal alternative will require the procurement of necessary equipment and a labor force for completion. Comparisons of the costs associated with the alternatives also indicates that the Hazard Mitigation alternative is preferred.

If the assumption is that the area will be managed as a wildlife refuge, the Hazard Mitigation alternative is considered to be appropriate. If the land use scenario chosen is for unrestricted land use, the only alternative that will adequately protect human health and the environment is the Hazard Removal alternative in which removal of the demolition debris is included.

9.0 REFERENCES

DOE-RL, 1993, *Hanford Site Background: Part 1, Soil Background for Non-Radioactive Analytes*, DOE/RL-92-24, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology et al., 1989, et seq., *Hanford Federal Facility Agreement and Consent Order*, U.S. Department of Energy, U.S. Environmental Protection Agency, and Washington Department of Ecology, Olympia, Washington.

EPA, 1986, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 1990a, *EPA Contract Laboratory Program Statement of Work for Organic Analyses, Multi-Media, Multi-Concentration*, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1990b, *EPA Contract Laboratory Program Statement of Work for Inorganic Analyses, Multi-Media, Multi-Concentration*, U.S. Environmental Protection Agency, Washington, D.C.

Gustafson, F. W., 1991, *Site Selection Process for Expedited Response Actions at the Hanford Site*, WHC-SD-EN- - , Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Howard, P. H., 1991, *Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Vol III - Pesticides*, Lewis Publishers, Inc., Chelsea, Michigan.

WHC, 1990, *North Slope Investigation Report*, WHC-EP-0359, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991, *Waste Information Data System (WIDS)*, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992a, *North Slope Expedited Response Action Proposal*, WHC-SD-EN- -007, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992b, *Geophysical Surveys of Military Landfills Located on Hanford's Wahluke (North) Slope*, WHC-SD-EN-ER-001, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992c, *Data Validation Procedures for Chemical Analyses*, WHC-SD-EN-SPP-002, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX A

LABORATORY ANALYTICAL RESULTS

SAMPLE NUMBER	B07GM0	B07GM1	B07GM2	B07GM3	B07GM4	B07GM5
LOCATION	H-83-L/A-2-2	H-83-L/A-2-3	H-83-L/A-1-3	H-83-L/A-3-2	H-83-L/A-3-3	H-83-L/A-4-1
COMMENTS	9-11 ft, SW-846	9-11 ft, CLP	9-11 ft, SW-846	9-11 ft, CLP	9-11 ft, SW-846	9-11 ft, SW-846
SEMI-VOA (ug/kg)						
di-n-butylphthalate	140 JB	U	U	U	U	U
diethyl phthalate	U	U	U	U	U	U
phenanthrene	U	U	U	U	U	U
fluoranthene	U	U	U	U	U	U
pyrene	U	U	U	U	U	U
benzo(a)anthracene	U	U	U	U	U	U
chrysene	U	U	U	U	U	U
benzo(b)fluoranthene	U	U	U	U	U	U
benzo(k)fluoranthene	U	U	U	U	U	U
benzo(a)pyrene	U	U	U	U	U	U
bis(2-ethylhexyl)phthalate		U	U	U	U	U
indeno(1,2,3-cd)pyrene	U	U	U	U	U	U
dibenzo(a,h)anthracene	U	U	U	U	U	U
benzo(g,h,i)perylene	U	U	U	U	U	U
VOA (ug/kg)						
acetone	U	5 BJ	3.8	5 BJ	4.3	5.8
2-hexanone	9.8	U	3.8	U	U	U
methylene chloride	U	U	U	U	U	U
toluene	U	U	U	U	U	U
methyl-pentanone	U	U	U	U	U	U
ICP METALS (ug/g)						
Al	7300	7000	7700	6510	9800	8000
Sb	U	UN	U	UN	U	U
Ba	67	70.2	77	119 E	100	88
Be	U	U	U	U	U	U
Cd	U	U	U	U	U	U
Ca	9800	9000	9400	8670	11000	11000
Cr	12	12	13	11	14	13
Co	5	5.2 B	7	5.1 B	8	7
Cu	9	21.2 *	13	11 *	12	12
Fe	14000	14500	20000	14500	20000	18000
Li	10	NA	10	NA	12	11
Mg	5200	5060	5500	4690	6100	5700
Mn	270	273	350	283	370	340
Mo	U	NA	U	NA	U	U
Ni	11	11.2	12	11.6	14	11
P	400	NA	570	NA	550	530
K	1400	1330	1700	1420	1800	1700
Ag	U	U	U	UNW	U	U
Na	170	245 B	160	269 B	240	190
Sr	37	NA	32	NA	47	36
V	26	26.5	32	26.2	43	35
Zn	35	37.4	46	48.2	45	42
Hg		0.068		0.05 B		
As		3.3		3.3		
Pb		5.5 N*		9.2 N*		
Se		UNW		U		
Tl		U		U		
AA METALS (ug/g)						
As	2.9		4.7		3.3	3.6
Pb	5.6		22		4.6	5.2
Se	U		U		U	U
Tl	U		U		U	U
MERCURY (ug/g)	U	0.06 B	U	0.05 B	U	U

SAMPLE NUMBER	B07GM0	B07GM1	B07GM2	B07GM3	B07GM4	B07GM5
LOCATION	H-83-L/A-2-2	H-83-L/A-2-3	H-83-L/A-1-3	H-83-L/A-3-2	H-83-L/A-3-3	H-83-L/A-4-1
COMMENTS	9-11 ft, SW-846	9-11 ft, CLP	9-11 ft, SW-846	9-11 ft, CLP	9-11 ft, SW-846	9-11 ft, SW-846
HERBICIDES (ug/kg)						
2,4-D	U	U	U	U	U	U
2,4-DB	U	U	U	U	U	U
2,4,5-T	U	U	U	U	TBA	TBA
2,4,5-TP	U	U	U	U	U	U
Dalapon	U	U	U	U	U	U
Dicamba	U	U	U	U	U	U
Dichloroprop	U	U	U	U	U	U
Dinoseb	U	U	U	U	U	U
MCPA	U	U	U	U	U	U
MCPP	U	U	U	U	U	U
TTL PET. HYDROCARBONS (ug/g)	U	U	20	U	U	U
PCB/Pesticides (ug/kg)						
DDE	U	2.5 JP	150	17	U	49
DDD	U	2.4 J	U	U	U	U
DDT	220	7.1	35	5.3 P	U	59
Dieldrin	U	0.55 JP	36	U	U	10
Endrin	U	U	U	U	U	U
Methoxychlor	U	19 B	U	49 B	U	U
Endosulfan II	U	U	U	U	U	NA
Alpha Chlordane	NA	U	NA	U	NA	U
Aroclor 1254	U	U	U	U	U	U
Gamma-BHC (Lindane)	U	U	U	U	U	U
Beta-BHC	U	U	U	U	U	U
Endosulfan I	U	U	U	U	U	U
Endosulfan sulfate	U	U	U	U	U	U
Endrin ketone	NA	U	NA	U	NA	NA
ANIONS (ug/g)						
F	U	U	U	U	2	U
CL	U	3	9	14	7	6
PO4-P	U	U	U	U	U	U
So4	6	8	14	46	11	18
No3-N+No2-N	1	2	3	4	2	5
Cr-6	U	U	U	U	U	U
PHOSPH-PEST (ug/kg)						
TPP	NA	NA	NA	NA	NA	NA

SAMPLE NUMBER	B07GM6	B07GM7	B07GM8	B07GM9	B07GN0	B07GN1
LOCATION	H-04(W)/A-1-2	H-04(W)/A-1-3	H-04(W)/A-1-3	H-04(W)/A-1-3	H-04(W)/A-2-2	H-04(W)/A-3-1
COMMENTS	9-11 ft, SW-846	8-9 ft, CLP	8-9 ft, CLP, duplicate	8-9 ft, CLP, split	7.5-9.5 ft, SW-846	7-9 ft, SW-846
SEMI-VOA (ug/kg)						
di-n-butylphthalate	U	U	130 J	U	U	54
diethyl phthalate	U	U	52 J	U	U	U
phenanthrene	U	U	U	U	U	U
fluoranthene	U	U	U	U	U	U
pyrene	U	U	U	U	U	U
benzo(a)anthracene	U	U	U	U	U	U
chrysene	U	U	U	U	U	U
benzo(b)fluoranthene	U	U	U	U	U	U
benzo(k)fluoranthene	U	U	U	U	U	U
benzo(a)pyrene	U	U	U	U	U	U
bis(2-ethylhexyl)phthalate	U	100 BJ	52 BJ	U	U	U
indeno(1,2,3-cd)pyrene	U	U	U	U	U	U
dibenzo(a,h)anthracene	U	U	U	U	U	U
benzo(g,h,i)perylene	U	U	U	U	U	U
VOA (ug/kg)						
acetone	67	34 B	34 B	42 B	31	46
2-hexanone	U	U	U	U	U	U
methylene chloride	U	U	U	26 B	U	1.3
toluene	U	U	U	U	U	2.6
methyl-pentanone	U	U	U	U	U	U
ICP METALS (ug/g)						
Al	13000	14400	14400	15400	17000	20000
Sb	U	U N	U N	U N	U	U
Ba	110	401	431	346	280	130
Be	1	0.92 B	0.88 B	1.2	U	U
Cd	U	U	U	0.7 B	U	U
Ca	22000	17300	17600	16300	21000	19000
Cr	11	14.8	13.8	15.5	17	15
Co	9	8.2 B	9 B	10.2 B	9	11
Cu	13	29.5	21.5	20.9	14	16
Fe	11000	19000	19100	22000	20000	19000
Li	9	NA	NA	NA	15	13
Mg	5100	7480	7400	7260	6300	9200
Mn	230	299	334	362	360	370
Mo	U	NA	NA	NA	U	U
Ni	11	8.2 B	13.6	14.8	16	15
P	130	NA	NA	NA	450	500
K	1000	1560	1590	1820	1300	2000
Ag	U	U	U	16.5 N	U	U
Na	490	590 BE	590 E	706 B	720	690
Sr	68	NA	NA	NA	92	100
V	28	43.3	43.3	46.6	73	45
Zn	25	41.9	45.6	55.7	41	71
Hg		U	U	U		
As		5.6	5.5	U WN		
Pb		15.7	15	18.9 *		
Se		U NW	U NW	U WN		
Tl		0.32 B	U	U WN		
AA METALS (ug/g)						
As	4.2				8.1	8.5
Pb	7.1				5.8	14
Se	U				U	U
Tl	U				U	U
MERCURY (ug/g)	U				U	U

SAMPLE NUMBER LOCATION COMMENTS	B07GM6 H-04(W)/A-1-2 9-11 ft, SW-846	B07GM7 H-04(W)/A-1-3 8-9 ft, CLP	B07GM8 H-04(W)/A-1-3 8-9 ft, CLP, duplicate	B07GM9 H-04(W)/A-1-3 8-9 ft, CLP, split	B07GN0 H-04(W)/A-2-2 7.5-9.5 ft, SW-846	B07GN1 H-04(W)/A-3-1 7-9 ft, SW-846
HERBICIDES (ug/kg)						
2,4-D	U	U	U	U	U	U
2,4-DB	U	U	U	182	U	U
2,4,5-T	U	U	U	66.4	U	U
2,4,5-TP	U	U	U	U	U	U
Dalapon	U	U	U	U	U	U
Dicamba	U	U	U	U	U	U
Dichloroprop	U	U	U	152	U	U
Dinoseb	U	U	U	U	U	U
MCPA	U	U	U	U	U	U
MCPP	U	U	U	U	U	U
TTL PET. HYDROCARBONS (ug/g)	U	U	50		U	30
PCB/Pesticides (ug/kg)						
DDE	U	78	140	70.9	U	44
DDD	U	1.3 JP	1.5 JP	U	U	U
DDT	U	24	46	18.4	U	65
Dieldrin	U	U	U	NA	U	U
Endrin	U	0.057 JB	0.85 JP	U	U	U
Methoxychlor	U	390 B	3 PB	U	U	U
Endosulfan II	U	U	U	U	U	U
Alpha Chlordane	NA	U	U	U	NA	NA
Aroclor 1254	U	U	U	U	U	U
Gamma-BHC (Lindane)	U	U	U	U	U	U
Beta-BHC	U	U	U	U	U	U
Endosulfan I	U	U	U	U	U	U
Endosulfan sulfate	U	U	U	U	U	U
Endrin ketone	NA	U	U	U	NA	NA
ANIONS (ug/g)						
F	U	3	3	4.62	3	7
CL	33	27	28	32.6	62	190
PO4-P	U	U	U	0.62	U	U
So4	280	880	770	851	1300	3100
No3-N+No2-N	6	4	4	0.4	6	10
Cr-6	U	U	U	0.0078	U	U
PHOSPH-PEST (ug/kg)						
TPP	303	139	166	NA	305	329

SAMPLE NUMBER LOCATION COMMENTS		B07GN2 H-04(E)/A-1-1 7-9 ft, SW-846	B07GN3 H-04(E)/A-1-2 8-10 ft, CLP	B07GN4 H-06-H(W)/A-2-2 9-11 ft, SW-846	B07GN5 H-06-H(W)/A-5-2 9-11 ft, SW-846	B07GN6 H-06-H(W)/A-5-5 9-11 ft, CLP		B07GN7 H-06-H(W)/A-7-1 9-11 ft, SW-846
SEMI-VOA (ug/kg)								
di-n-butylphthalate	J	U	U	U	U	66 J		U
diethyl phthalate		970	U	U	U	22 J		U
phenanthrene		95 J	U	U	U	U		U
fluoranthene		220 J	U	U	U	U		U
pyrene		240 J	U	U	U	U		U
benzo(a)anthracene		220 J	U	U	U	U		U
chrysene		310 J	U	U	U	U		U
benzo(b)fluoranthene		400	U	U	U	U		U
benzo(k)fluoranthene		340 J	U	U	U	U		U
benzo(a)pyrene		360	U	U	U	U		U
bis(2-ethylhexyl)phthalate		970	96 BJ	U	U	58 BJ		U
indeno(1,2,3-cd)pyrene		390	U	U	U	U		U
dibenzo(a,h)anthracene		140 J	U	U	U	U		U
benzo(g,h,i)perylene		450	U	U	U	U		U
VOA (ug/kg)								
acetone		31	32 B	32	49	24 B		40
2-hexanone		U	U	U	U	U		U
methylene chloride	J	U	U	U	U	U		U
toluene		U	U	U	U	U		U
methyl-pentanone		U	U	U	U	3	J	U
ICP METALS (ug/g)								
Al		9700	10500	13000	10000	13300		12000
Sb		U	UN	U	U	UN		U
Ba		98	308	130	110	114		110
Be		U	0.78 B	U	U	0.54 B		U
Cd		U	U	U	U	U		U
Ca		14000	23900	14000	9800	14600		13000
Cr		11	12.6	18	14	19		18
Co		9	6.8 B	10	9	10.8		10
Cu		15	16.3	18	15	21.1		21
Fe		22000	19200	21000	20000	23400		21000
Li		10	NA	15	12	NA		15
Mg		5900	6180	7500	5900	7580		7100
Mn		350	341	420	380	466 *		550
Mo		U	NA	U	U	NA		U
Ni		13	9.9	19	16	19.2		18
P		730	NA	620	620	NA		620
K		1300	1250	2100	1800	2130		2000
Ag		U	U	U	U	U		U
Na		410	516 BE	530	550	588 BE		520
Sr		59	NA	54	42	NA		53
V		51	48.2	38	40	44.2		36
Zn		46	38.5	52	58	58.6		250
Hg			U			U		
As			6.6			8.1		
Pb			11.4 NS			15 NS		
Se			U			U NW		
Tl			U			U		
AA METALS (ug/g)								
As		4.3		5.3	4.6			5.5
Pb		6.7		8.2	7.8			47
Se		U		U	U			U
Tl		U		U	U			U
MERCURY (ug/g)		U		U	U			U

SAMPLE NUMBER LOCATION COMMENTS	B07GN2 H-04(E)/A-1-1 7-9 ft, SW-846	B07GN3 H-04(E)/A-1-2 8-10 ft, CLP	B07GN4 H-06-H(W)/A-2-2 9-11 ft, SW-846	B07GN5 H-06-H(W)/A-5-2 9-11 ft, SW-846	B07GN6 H-06-H(W)/A-5-5 9-11 ft, CLP	B07GN7 H-06-H(W)/A-7-1 9-11 ft, SW-846
HERBICIDES (ug/kg)						
2,4-D	U	U	U	U	U	U
2,4-DB	U	U	U	U	U	U
2,4,5-T	U	U	U	U	U	U
2,4,5-TP	U	U	U	U	U	U
Dalapon	U	U	U	U	U	U
Dicamba	U	U	U	U	U	U
Dichloroprop	U	U	U	U	U	U
Dinoseb	U	U	U	U	U	U
MCPA	U	U	U	U	U	U
MCPP	U	U	U	U	U	U
TTL PET. HYDROCARBONS (ug/g)	U	U	U	U	U	U
PCB/Pesticides (ug/kg)						
DDE	U	6.2	U	U	3.3 J	U
DDD	U	U	U	U	U	U
DDT	U	3 J	U	U	2.9 J	U
Dieldrin	U	U	U	U	U	U
Endrin	U	U	U	U	U	U
Methoxychlor	U	3 PB	U	U	5.7 B	U
Endosulfan II	U	U	U	U	U	U
Alpha Chlordane	NA	U	NA	NA	U	NA
Aroclor 1254	U	U	U	U	U	U
Gamma-BHC (Lindane)	U	U	U	U	U	U
Beta-BHC	U	U	U	U	U	U
Endosulfan I	U	U	U	U	U	U
Endosulfan sulfate	U	U	U	U	U	U
Endrin ketone	NA	U	NA	NA	U	NA
ANIONS (ug/g)						
F	3	3	4	2	3	6
CL	U	2	73	28	73	6
PO4-P	U	U	U	1.3	U	U
So4	28	13	270	200	170	42
No3-N+No2-N	1	2	6	3	3	2
Cr-6	U	U	U	U	U	U
PHOSPH-PEST (ug/kg)						
TPP	323	112	317	324	236	325

SAMPLE NUMBER LOCATION COMMENTS	B07GN8 H-06-H(W)/A-16-1 9-11 ft, SW-846	B07GN9 Equip. Blank(sand) CLP	B07GP0 H-06-H(W)/A-19-2 9-11 ft, SW-846	B07GP1 H-06-H(W)/A-19-3 9-11 ft, CLP	B07GP2 H-06-H(E)/A-2-1 9-11 ft, SW-846	B07GP3 H-06H(E)/A-6-4 9-11 ft, SW-846
SEMI-VOA (ug/kg)						
di-n-butylphthalate	U	U	400	110 J	110 J	91
diethyl phthalate	U	U	U	37 J	U	U
phenanthrene	U	U	U	U	U	U
fluoranthene	U	U	U	U	U	U
pyrene	U	U	U	U	U	U
benzo(a)anthracene	U	U	U	U	U	U
chrysene	U	U	U	U	U	U
benzo(b)fluoranthene	U	U	U	U	U	U
benzo(k)fluoranthene	U	U	U	U	U	U
benzo(a)pyrene	U	U	U	U	U	U
bis(2-ethylhexyl)phthalate	U	U	U	120 J	110 J	U
indeno(1,2,3-cd)pyrene	U	U	U	U	U	U
dibenzo(a,h)anthracene	U	U	U	U	U	U
benzo(g,h,i)perylene	U	U	U	U	U	U
VOA (ug/kg)						
acetone	33	21 B	22	21 B	26	22
2-hexanone	U	U	U	U	U	U
methylene chloride	U	U	U	U	U	U
toluene	U	U	U	U	U	U
methyl-pentanone	U	3	J U	U	U	U
ICP METALS (ug/g)						
Al	13000	131	15000	11100	19000	20000
Sb	U	UN	U	UN	U	U
Ba	120	1.4 B	130	120	130	130
Be	U	U	U	0.55 B	U	U
Cd	U	U	U	U	U	U
Ca	15000	29.9 B	13000	14600	17000	18000
Cr	18	U	23	17.9	25	25
Co	10	U	8	8.8 B	10	10
Cu	21	U	35	53.5	43	31
Fe	22000	170	29000	20800	26000	25000
Li	15	NA	16	NA	21	20
Mg	7600	20.8 B	7300	7250	9100	8800
Mn	430	3.9	470	424	500	460
Mo	U	NA	U	U	2	U
Ni	17	U	18	16.1	22	21
P	600	NA	810	NA	590	600
K	2100	U	2700	2230	3000	3100
Ag	U	U	U	U	U	U
Na	640	11.8 B	540	271 BE	790	560
Sr	58	NA	54	NA	65	64
V	38	U	42	38	44	43
Zn	58	U	87	72.2	62	61
Hg		U		U		
As		U		11.1		
Pb		0.65		20.1 S*		
Se		0.23 B		UNW		
Tl		U		0.6 B		
AA METALS (ug/g)						
As	5.5		7.2		8.5	9.2
Pb	9.9		36		13	11
Se	U		U		U	U
Tl	U		U		U	U
MERCURY (ug/g)	U		U		U	U

SAMPLE NUMBER LOCATION COMMENTS	B07GN8 H-06-H(W)/A-16-1 9-11 ft, SW-846	B07GN9 Equip. Blank(sand) CLP	B07GP0 H-06-H(W)/A-19-2 9-11 ft, SW-846	B07GP1 H-06-H(W)/A-19-3 9-11 ft, CLP	B07GP2 H-06-H(E)/A-2-1 9-11 ft, SW-846	B07GP3 H-06H(E)/A-6-4 9-11 ft, SW-846
HERBICIDES (ug/kg)						
2,4-D	U	U	U	U	U	U
2,4-DB	U	U	U	U	U	U
2,4,5-T	U	U	U	U	U	U
2,4,5-TP	U	U	U	U	U	U
Dalapon	U	U	U	U	U	U
Dicamba	U	U	U	U	U	U
Dichloroprop	U	U	U	U	U	U
Dinoseb	U	U	U	U	U	U
MCPA	U	U	U	U	U	U
MCPP	U	U	U	U	U	U
TTL PET. HYDROCARBONS (ug/g)	U	U	U	90	U	U
PCB/Pesticides (ug/kg)						
DDE	U	U	U	11 X	U	U
DDD	U	U	U	1.4 JPX	U	U
DDT	U	U	U	U	U	U
Dieldrin	U	U	U	2.3 JPX	U	U
Endrin	U	1.5 PB	U	10 PX	U	U
Methoxychlor	U	U	U	0.71 JPB	U	U
Endosulfan II	U	U	U	0.84 JPX	U	U
Alpha Chlordane	NA	U	NA	4.9 PX	NA	NA
Aroclor 1254	U	U	U	210 P	U	U
Gamma-BHC (Lindane)	NA	U	NA	U	NA	NA
Beta-BHC	U	U	U	U	U	U
Endosulfan I	U	U	U	U	U	U
Endosulfan sulfate	U	U	U	U	U	U
Endrin ketone	NA	U	NA	U	NA	NA
ANIONS (ug/g)						
F	4	U	3	3	5	3
CL	3	U	140	15	75	78
PO4-P	U	U	U	U	U	U
So4	200	U	140	1300	180	120
No3-N+No2-N	1	U	16	25	12	2
Cr-6	U	U	U	U	U	U
PHOSPH-PEST (ug/kg)						
TPP	336	347	U	U	U	U

SAMPLE NUMBER LOCATION COMMENTS	B07GP4 Equip. Blank (sand) CLP	B07KP4 H-06-H(E)/A-11-1 9-11 ft, CLP	B07KP5 H-06-H(E)/A-11-1 9-11 ft, CLP, duplicate	B07KP6 H-06-H(E)/A-11-1 9-11 ft, CLP, split	B07KP7 H-06-H(E)/A-11-2 9-11 ft, SW-846
SEMI-VOA (ug/kg)					
di-n-butylphthalate J	70 J	260 BJ	200 J	260 J	U
diethyl phthalate	39 J	U	U	U	U
phenanthrene	U	U	U	U	U
fluoranthene	U	U	U	U	U
pyrene	U	U	U	U	U
benzo(a)anthracene	U	U	U	U	U
chrysene	U	U	U	U	U
benzo(b)fluoranthene	U	U	U	U	U
benzo(k)fluoranthene	U	U	U	U	U
benzo(a)pyrene	U	U	U	U	U
bis(2-ethylhexyl)phthalate	U	U	U	U	U
indeno(1,2,3-cd)pyrene	U	U	U	U	U
dibenzo(a,h)anthracene	U	U	U	U	U
benzo(g,h,i)perylene	U	U	U	U	U
VOA (ug/kg)					
acetone	23 B	25 B	73 B	7 JB	12
2-hexanone	U	U	U	U	U
methylene chloride	U	U	U	6 JB	U
toluene	U	U	U	U	U
methyl-pentanone	U	U	U	U	U
ICP METALS (ug/g)					
Al	138	13300	13900	13400	19000
Sb	U	U N	13.9 N	U	U
Ba	1.5 B	163	167	157	150
Be	U	0.61 B	0.6 B	0.64 B	U
Cd	U	U	1.9	0.64 B	U
Ca	26.9 B	15000	15100	16100	16000
Cr	U	20.2	22.4	21	26
Co	U	10.5 B	11.4	14.6	10
Cu	U	22.3	24.2	27.1	24
Fe	185	24400	30300	27800	26000
Li	NA	NA	NA	NA	21
Mg	U	7580	7810	7700	9000
Mn	4.3	524	533	571	500
Mo	NA	NA	NA	NA	U
Ni	U	20.8	19.6	20.8	23
P	NA	NA	NA	NA	580
K	U	2170	2220	2330	2600
Ag	U	U	U	7	U
Na	7.5 B	367 BE	373 BE	U	600
Sr	NA	NA	NA	NA	60
V	U	45.5	47.3	52.2	44
Zn	U	117	161	96.1	73
Hg	U	U	U	U	
As	U	7.3	6.3	10.6 B	
Pb	0.32 B	190 *	26.5 S*	29.9	
Se	U	U NW	U NW	U	
Tl	U	0.24 B	U	U	
AA METALS (ug/g)					
As					5.1
Pb					21
Se					U
Tl					U
MERCURY (ug/g)					

SAMPLE NUMBER LOCATION COMMENTS	B07GP4 Equip. Blank (sand) CLP	B07KP4 H-06-H(E)/A-11-1 9-11 ft, CLP	B07KP5 H-06-H(E)/A-11-1 9-11 ft, CLP, duplicate	B07KP6 H-06-H(E)/A-11-1 9-11 ft, CLP, split	B07KP7 H-06-H(E)/A-11-2 9-11 ft, SW-846
HERBICIDES (ug/kg)					
2,4-D	U	U	U	U	U
2,4-DB	U	U	U	U	U
2,4,5-T	U	U	U	U	U
2,4,5-TP	U	U	U	U	U
Dalapon	U	U	U	U	U
Dicamba	U	U	U	U	U
Dichloroprop	U	U	U	U	U
Dinoseb	U	U	U	U	U
MCPA	U	U	U	U	U
MCPP	U	U	U	U	U
TTL PET. HYDROCARBONS (ug/g)	U	20	U	U	U
PCB/Pesticides (ug/kg)					
DDE	U	150 PY	170 PY	282 EC	34
DDD	U	1.4 JP	2.2 JP		U
DDT	U	210 PY	260 PY	341 EC	36
Dieldrin	0.061 JP	4 P	7.5	U	U
Endrin	U	U	U	U	U
Methoxychlor	0.55 JPB	2.4 JPB	1.7 JPB	U	U
Endosulfan II	U	U	U	U	U
Alpha Chlordane	U	U	U	U	NA
Aroclor 1254	U	U	U	U	U
Gamma-BHC (Lindane)	U	U	U	U	NA
Beta-BHC	U	U	U	U	U
Endosulfan I	U	U	U	U	U
Endosulfan sulfate	U	U	U	U	NA
Endrin ketone	U	U	U	U	
ANIONS (ug/g)					
F	U	2	1	1.96	5
CL	2	7	7	10.9	9
PO4-P	U	U	U	1.43	U
So4	1	830	550	311	42
No3-N+No2-N	U	2	2	13.01<.2	2
Cr-6	U	U	U	<0.133	U
PHOSPH-PEST (ug/kg)					
TPP	U	U	U	NA	NA

SAMPLE NUMBER	B07KP8	B07KP9	B07KQ0	B07KQ1	B07KQ2	B07KQ3
LOCATION	H-06-H(E)/A-12-1	H-06-H(E)/A-12-2	H-06-H(E)/A-7-1	H-81-R	H-06-L	H-06-L
COMMENTS	9-11 ft, CLP	9-11 ft, SW-846	9-11 ft, SW-846	4-6 ft, CLP	3 ft, CLP	13-15 ft, CLP
SEMI-VOA (ug/kg)						
di-n-butylphthalate	63 J	U	U	U	U	U
diethyl phthalate	U	U	U	U	U	U
phenanthrene	U	U	U	U	U	U
fluoranthene	U	U	U	U	U	U
pyrene	U	U	U	U	U	U
benzo(a)anthracene	U	U	U	U	U	U
chrysene	U	U	U	U	U	U
benzo(b)fluoranthene	U	U	U	U	U	U
benzo(k)fluoranthene	U	U	U	U	U	U
benzo(a)pyrene	U	U	U	U	U	U
bis(2-ethylhexyl)phthalate	60 J	U	82 J	U	U	U
indeno(1,2,3-cd)pyrene	U	U	U	U	U	U
dibenzo(a,h)anthracene	U	U	U	U	U	U
benzo(g,h,i)perylene	U	U	U	U	U	U
VOA (ug/kg)						
acetone	40 B	10	11	U	U	U
2-hexanone	U	U	U	U	U	U
methylene chloride	U	U	U	U	U	U
toluene	U	U	U	U	U	U
methyl-pentanone	U	U	U	U	U	U
ICP METALS (ug/g)						
Al	18100	20000	17000	7960	11500	29800
Sb	U N	U	U	U N	UN	U N
Ba	148	150	200	88.4	114	41.9 B
Be	0.76 B	U	U	0.47 B	0.79 B	1.3
Cd	U	U	U	U	U	U
Ca	17300	17000	16000	10800	12400	113000
Cr	24.1	25	25	10.4	15.5	23.1
Co	11.5	11	10	10.1 B	9.9 B	8.4 B
Cu	29.2	26	21	21.7	37.8	22.8
Fe	27300	26000	24000	29700	22100	23200
Li	NA	21	19	NA	NA	NA
Mg	8960	9200	8500	5930	6130	12100
Mn	497	510	460	475	417	176
Mo	NA	U	U	NA	NA	NA
Ni	20.3	22	20	13.1	13.6	16.3
P	NA	610	600	NA	NA	NA
K	2830	3000	2700	1120	2540	1510
Ag	U	U	U	U	U	U
Na	578 BE	570	610	189 B	235 B	719 BB
Sr	NA	62	62	NA	NA	NA
V	46.1	43	43	70.7	48.6	97.3
Zn	108	65	58	65.8	92.3	55.1
Hg	U			U	U	U
As	9.3			1.9	4.3	6.8
Pb	22.7 *			48.4	26.1	12 S
Se	U NW			U NW	U NW	U NW
Tl	U			U	U	U
AA METALS (ug/g)						
As		6.6	6.5			
Pb		14	11			
Se		U	U			
Tl		U	U			
MERCURY (ug/g)		U	U			

SAMPLE NUMBER	B07KP8	B07KP9	B07KQ0	B07KQ1	B07KQ2	B07KQ3
LOCATION	H-06-H(E)/A-12-1	H-06-H(E)/A-12-2	H-06-H(E)/A-7-1	H-61-R	H-06-L	H-06-L
COMMENTS	9-11 ft, CLP	9-11 ft, SW-846	9-11 ft, SW-846	4-6 ft, CLP	3 ft, CLP	13-15 ft, CLP
HERBICIDES (ug/kg)						
2,4-D	U	U	U	U	U	U
2,4-DB	U	U	U	U	U	U
2,4,5-T	U	U	U	U	U	U
2,4,5-TP	U	U	U	U	U	U
Dalapon	U	U	U	U	U	U
Dicamba	U	U	U	U	U	U
Dichlorprop	U	U	U	U	U	U
Dinoseb	U	U	U	U	U	U
MCPA	U	U	U	U	U	U
MCPP	U	U	U	U	U	U
TTL PET. HYDROCARBONS (ug/g)	U	U	U	910	U	U
PCB/Pesticides (ug/kg)						
DDE	100 PY	U	U	U	2.2 J	U
DDD	2.1 JP	U	U	U	U	U
DDT	96 PY	U	U	U	4.9	U
Dieldrin	10 P	U	U	0.46 JP	U	U
Endrin	0.69 JP	U	U	U	0.86 J	U
Methoxychlor	1.6 JPB	U	U	1.3 JPB	2.2 JPB	2 JB
Endosulfan II	U	U	U	U	U	U
Alpha Chlordane	U	NA	NA	0.35 JP	U	U
Aroclor 1254	U	U	U	U	U	U
Gamma-BHC (Lindane)	1.2 JP	NA	NA	U	U	U
Beta-BHC	U	U	U	1.9 P	U	U
Endosulfan I	U	U	U	0.13 JP	U	U
Endosulfan sulfate	U	U	U	1.5 JP	0.19 JP	0.21 JP
Endrin ketone	U	NA	NA	U	U	U
ANIONS (ug/g)						
F	4	5	5	U	U	4
CL	52	4	28	3	6	2
PO4-P	U	U	U	U	6	U
So4	150	45	240	14	28	330
No3-N+No2-N	8	U	1	5	77	3
Cr-6	U	U	U	3	21	U
PHOSPH-PEST (ug/kg)						
TPP	NA	NA	NA	300	310	350

SAMPLE NUMBER LOCATION COMMENTS	B07KQ4 Hm – stead 6 in, CLP	B07KQ5 2,4–D 13–15 ft, CLP	B07KQ6 2,4–D 13–15 ft, SW–846	B07KQ7 2,4–D CLP	B07KR3 H–12–L 4 ft, CLP	B07KR4 H–12–L 4 ft, SW–846
SEMI–VOA (ug/kg)						
di–n–butylphthalate	100 BJ		U	U	NA	NA
diethyl phthalate	U	U	U	U	NA	NA
phenanthrene	U	U	U	U	NA	NA
fluoranthene	U	U	U	U	NA	NA
pyrene	U	U	U	U	NA	NA
benzo(a)anthracene	U	U	U	U	NA	NA
chrysene	U	U	U	U	NA	NA
benzo(b)fluoranthene	U	U	U	U	NA	NA
benzo(k)fluoranthene	U	U	U	U	NA	NA
benzo(a)pyrene	U	U	U	U	NA	NA
bis(2–ethylhexyl)phthalate	U	U	U	U	NA	NA
indeno(1,2,3–cd)pyrene	U	U	U	U	NA	NA
dibenzo(a,h)anthracene	U	U	U	U	NA	NA
benzo(g,h,i)perylene	U	U	U	U	NA	NA
VOA (ug/kg)						
acetone	NA	NA	NA	NA	NA	NA
2–hexanone	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA
methyl–pentanone	NA	NA	NA	NA	NA	NA
ICP METALS (ug/g)						
Al	7410	NA	NA	NA	7950	7100
Sb	10.5 N	NA	NA	NA	U	U
Ba	126 N	NA	NA	NA	71.3	59
Be	U	NA	NA	NA	0.39 B	U
Cd	U	NA	NA	NA	U	U
Ca	4100	NA	NA	NA	4300	3200
Cr	16.8 N	NA	NA	NA	11.4	11
Co	9.5 B	NA	NA	NA	7.8 B	6
Cu	40.7 N*	NA	NA	NA	17.3	10
Fe	39000 *	NA	NA	NA	16300	16000
Li	NA	NA	NA	NA	NA	8
Mg	3690	NA	NA	NA	4120	4000
Mn	422 N	NA	NA	NA	267 N	250
Mo	NA	NA	NA	NA	NA	U
Ni	23.4 *	NA	NA	NA	6.7 B	10
P	1550	NA	NA	NA	1600	530
K	NA	NA	NA	NA	NA	1300
Ag	U	NA	NA	NA	U	U
Na	175 B	NA	NA	NA	411 B	220
Sr	NA	NA	NA	NA	NA	19
V	45.3	NA	NA	NA	35.2	36
Zn	144 N*	NA	NA	NA	33.6	34
Hg	U	NA		NA	U N	
As	3.4 NS	NA		NA	2.3	
Pb	216	NA		NA	4.7 NS	
Se	0.35 B	NA		NA	0.24 B	
Tl	0.18 BW	NA		NA	0.1 B	
AA METALS (ug/g)						
As		NA	NA	NA		1.8
Pb		NA	NA	NA		4.3
Se		NA	NA	NA		U
Tl		NA	NA	NA		U
MERCURY (ug/g)		NA	NA	NA		U

SAMPLE NUMBER LOCATION COMMENTS	B07KQ4 Hm-stead 6 In, CLP	B07KQ5 2,4-D 13-15 ft, CLP	B07KQ6 2,4-D 13-15 ft, SW-846	B07KQ7 2,4-D CLP	B07KR3 H-12-L 4 ft, CLP	B07KR4 H-12-L 4 ft, SW-846
HERBICIDES (ug/kg)						
2,4-D	U	U	U	U	NA	NA
2,4-DB	U	U	U	U	NA	NA
2,4,5-T	U	U	U	U	NA	NA
2,4,5-TP	U	U	U	U	NA	NA
Dalapon	U	U	U	U	NA	NA
Dicamba	U	U	U	U	NA	NA
Dichloroprop	U	U	U	U	NA	NA
Dinoseb	U	U	U	U	NA	NA
MCPA	U	U	U	U	NA	NA
MCPP	U	U	U	U	NA	NA
TTL PET. HYDROCARBONS (ug/g)	U	NA	NA	NA	NA	NA
PCB/Pesticides (ug/kg)						
DDE	U	U	SEE RECORD OF DISPOSITION	U	NA	NA
DDD	U	U		U	NA	NA
DDT	4.5	U		U	NA	NA
Dieldrin	1.2 JP	U		U	NA	NA
Endrin	U	U		U	NA	NA
Methoxychlor	2.5 JPB	U		U	NA	NA
Endosulfan II	U	U		U	NA	NA
Alpha Chlordane	U	U		U	NA	NA
Aroclor 1254	U	U		U	NA	NA
Gamma-BHC (Lindane)	U	U		U	NA	NA
Beta-BHC	U	U		U	NA	NA
Endosulfan I	U	U		U	NA	NA
Endosulfan sulfate	U	0.079 JP		U	NA	NA
Endrin ketone	0.47 JP	U		U	NA	NA
ANIONS (ug/g)						
F	U	NA	NA	NA	15	U
CL	12	NA	NA	NA	55	20
PO4-P	5	NA	NA	NA	U	U
So4	11	NA	NA	NA	31	20
No3-N+No2-N	2	NA	NA	NA	1	1
Cr-6	U	NA	NA	NA	2	2
PHOSPH-PEST (ug/kg)						
TPP	230.8	330	370	370	NA	NA

SAMPLE NUMBER	B07KR5	B07KR6	B07KR7	B07KR8	B07KR9
LOCATION	H-07-H	H-07-H	H-07-H	H-06-H	H-90
COMMENTS	16 ft, CLP	16 ft, CLP duplicate	16 ft, CLP split	9-11 ft, CLP	SW-846
SEMI-VOA (ug/kg)					
di-n-butylphthalate	U	U	U	U	NA
diethyl phthalate	U	U	U	U	NA
phenanthrene	U	U	U	U	NA
fluoranthene	U	U	U	U	NA
pyrene	U	U	U	U	NA
benzo(a)anthracene	U	U	U	U	NA
chrysene	U	U	U	U	NA
benzo(b)fluoranthene	U	U	U	U	NA
benzo(k)fluoranthene	U	U	U	U	NA
benzo(a)pyrene	U	U	U	U	NA
bis(2-ethylhexyl)phthalate	U	U	U	32 BJ	NA
indeno(1,2,3-cd)pyrene	U	U	U	U	NA
dibenzo(a,h)anthracene	U	U	U	U	NA
benzo(g,h,i)perylene	U	U	U	U	NA
VOA (ug/kg)					
acetone	7 J	U	6 J	U	NA
2-hexanone	U	U	U	U	NA
methylene chloride	2 BJ	3 BJ	U	3 BJ	NA
toluene	U	0.8 BJ	U	U	NA
methyl-pentanone	U	U	U	U	NA
ICP METALS (ug/g)					
Al	11800	11900	11600	43.6	6500
Sb	U	U	5.4 BM	U	U
Ba	88	86.4	96.1	86.4	90
Be	0.56 B	0.56 B	0.69 B	U	U
Cd	1.2	1 B	1.8	U	U
Ca	11200	11000	12200	16.3 B	10000
Cr	17.8	18.4	17.1	U	12
Co	10.2 B	11.7	11.6	U	6
Cu	25.4	24.4	28.6	1.5 B	31
Fe	20600	20600	22900	320	18000
Li	NA	NA	NA	NA	6
Mg	6480	6320	6970	61 B	3900
Mn	310	303	369	U	240
Mo	NA	NA	NA	NA	U
Ni	17	13.4	16.9	U	9
P	2090	2130	NA	171 B	890
K	NA	NA	21.6	NA	1200
Ag	0.95 B	1.1 B	U	0.77 B	U
Na	413 B	412 B	161 B	18.2 B	320
Sr	NA	NA	NA	NA	41
V	41.1	39.9	46.4	U	46
Zn	92.3	88.2	103	U	290
Hg	U N	U N	U	U	
As	5.7	6	6.1 N	0.18 B	
Pb	19.7 N*	20.5 N*	21.3	0.18 B	
Se	0.41 BS	0.37 BW	0.52 B	0.27 B	
Tl	U	0.13 B	U N	U	
AA METALS (ug/g)					
As					690
Pb					1200
Se					U
Tl					U
MERCURY (ug/g)					0.09

SAMPLE NUMBER LOCATION COMMENTS	B07KR5 H-07-H 16 ft, CLP	B07KR6 H-07-H 16 ft, CLP duplicate	B07KR7 H-07-H 16 ft, CLP split	B07KR8 H-06-H 9-11 ft, CLP	B07KR9 H-90 SW-846
HERBICIDES (ug/kg)					
2,4-D	U	U	245	U	NA
2,4-DB	U	U	1210 B	U	NA
2,4,5-T	U	U	U	U	NA
2,4,5-TP	U	U	U	U	NA
Dalapon	U	U	NA	U	NA
Dicamba	U	U	U	U	NA
Dichloroprop	U	U	U	U	NA
Dinoseb	U	U	U	U	NA
MCPA	U	U	NA	U	NA
MCPP	U	U	NA	U	NA
TTL PET. HYDROCARBONS (ug/g)	60	60	72 mg/kg	U	60000
PCB/Pesticides (ug/kg)					
DDE	0.55 JP	0.55 JP	U	U	NA
DDD	1.1 P	1.2 P	U	U	NA
DDT	3.2 JP	3.1 J	NA	U	NA
Dieldrin	1.6 J	1.6 JP	U	U	NA
Endrin	U	U	U	U	NA
Methoxychlor	7.6 J	6.4 J	U	5.5 J	NA
Endosulfan II	U	0.57 PB	U	U	NA
Alpha Chlordane	U	U	U	U	NA
Aroclor 1254	U	U	U	U	NA
Gamma-BHC (Lindane)	U	U	U	U	NA
Beta-BHC	U	U	U	U	NA
Endosulfan I	U	U	U	U	NA
Endosulfan sulfate	U	U	U	U	NA
Endrin ketone	U	U	U	U	NA
ANIONS (ug/g)					
F	U	U	1.42	U	NA
CL	7	10	6.35	7	NA
PO4-P	U	U	4.58	U	NA
So4	26	26	23.7	5	NA
No3-N+No2-N	14	14	27.9	U	NA
Cr-6	2	2	<2.74 mg/kg	2	NA
PHOSPH-PEST (ug/kg)					
TPP	450	460	NA	450	NA

SAMPLE NUMBER LOCATION COMMENTS	B07K90 H-90 SW-846	B07K91 H-90 6 in, SW-846	B07K92 H-90 6 in, CLP
SEMI-VOA (ug/kg)			
di-n-butylphthalate	NA	NA	NA
diethyl phthalate	NA	NA	NA
phenanthrene	NA	NA	NA
fluoranthene	NA	NA	NA
pyrene	NA	NA	NA
benzo(a)anthracene	NA	NA	NA
chrysene	NA	NA	NA
benzo(b)fluoranthene	NA	NA	NA
benzo(k)fluoranthene	NA	NA	NA
benzo(a)pyrene	NA	NA	NA
bis(2-ethylhexyl)phthalate	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA
benzo(g,h,i)perylene	NA	NA	NA
VOA (ug/kg)			
acetone	NA	NA	NA
2-hexanone	NA	NA	NA
methylene chloride	NA	NA	NA
toluene	NA	NA	NA
methyl-pentanone	NA	NA	NA
ICP METALS (ug/g)			
Al	7700	7400	8450
Sb	U	U	19.9 N*
Ba	100	92	95.6
Be	U	U	0.52 B
Cd	1	U	U
Ca	9100	9200	11000
Cr	14	13	10.2
Co	7	6	11
Cu	29	23	16.2
Fe	19000	28000	20000
Li	6	7	NA
Mg	4300	4200	4420
Mn	250	350	391 N
Mo	U	U	NA
Ni	11	11	8.6
P	860	760	1430
K	1400	1400	NA
Ag	U	U	0.94 B
Na	440	270	610 BE
Sr	37	31	NA
V	46	52	51.5
Zn	490	230	56.5
Hg			U N
As			3.4
Pb			68.5 N*
Se			0.32 B
Tl			0.14 B
AA METALS (ug/g)			
As	3.1	2.1	
Pb	760	120	
Se	U	U	
Tl	U	U	
MERCURY (ug/g)	U	U	

SAMPLE NUMBER LOCATION COMMENTS	B07KS0 H-90 SW-846	B07KS1 H-90 6 in, SW-846	B07KS2 H-90 6 in, CLP
HERBICIDES (ug/kg)			
2,4-D	NA	NA	NA
2,4-DB	NA	NA	NA
2,4,5-T	NA	NA	NA
2,4,5-TP	NA	NA	NA
Dalapon	NA	NA	NA
Dicamba	NA	NA	NA
Dichloroprop	NA	NA	NA
Dinoseb	NA	NA	NA
MCPA	NA	NA	NA
MCPP	NA	NA	NA
TTL PET. HYDROCARBONS (ug/g)	65000	940	1700
PCB/Pesticides (ug/kg)			
DDE	NA	NA	NA
DDD	NA	NA	NA
DDT	NA	NA	NA
Dieldrin	NA	NA	NA
Endrin	NA	NA	NA
Methoxychlor	NA	NA	NA
Endosulfan II	NA	NA	NA
Alpha Chlordane	NA	NA	NA
Aroclor 1254	NA	NA	NA
Gamma-BHC (Lindane)	NA	NA	NA
Beta-BHC	NA	NA	NA
Endosulfan I	NA	NA	NA
Endosulfan sulfate	NA	NA	NA
Endrin ketone	NA	NA	U
ANIONS (ug/g)			
F	NA	NA	NA
CL	NA	NA	NA
PO4-P	NA	NA	NA
So4	NA	NA	NA
No3-N+No2-N	NA	NA	NA
Cr-6	NA	NA	NA
PHOSPH-PEST (ug/kg)			
TPP	NA	NA	NA

ORGANIC DATA QUALIFIERS

U - Indicates compound was analyzed for but not detected.
J - Indicates an estimated value.
P - This flag is used for a pesticide/Aroclor target analyte when there is greater than 25% difference for detected concentrations between the two GC columns.
C - This flag applies to pesticide results where the identification has been confirmed by GC/MS.
B - This flag is used when the analyte is found in the associated blank as well as in the sample.
E - This flag identifies compounds whose concentrations exceeded the calibration range of the GCMS instrument for that specific analysis.
D - This flag identifies all compounds identified in a analysis at a secondary dilution factor.
A - This flag indicates that a TIC is a suspected aldol-condensation product.
N - Indicates presumptive evidence of a compound.

INORGANIC DATA QUALIFIERS

C (Concentration) Qualifier: "B" will be entered if the reported value was obtained from a reading that was less than the Contract Required Detection. Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL). If the analyte was analyzed for but not detected, a "U" will be entered. The field will be left blank if the result is above the CRDL.

Q Qualifier: Specified entries and their meanings are as follows:
E - The reported value is estimated because of the presence of interference. An explanatory note must be included under Comments on the Cover Page or on the specific FORM I - IN.
M - Duplicate injection precision of 20% not met.
N - Spiked sample recovery not within control limits of 75-125%.
S - The reported value was determined by the Method of Standard Additions (MSA).
W - Post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while sample absorbance is less than 50% of spike absorbance.
* - Duplicate analysis not within control limits of 20% or +/- CRDL.
+ - Correlation coefficient for the MSA is less than 0.995.

PESTICIDE/PCB ANALYSIS

X - Used to flag the results of single component target pesticides in samples found to contain Aroclor 1254.
Y - Used to flag the results of compounds which were detected at levels above the concentration of the high standard.

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APPENDIX B

FIELD SCREENING ANALYTICAL RESULTS

North Slope Expedited Response Action
Volatile Organics Field Screening Results

Sample #	Site	Sample Date	Sample Time	Soil Type: Depth (ft)	Results
A2-1-001	H-83-L	10-12-92	1045	Sand w/wood: -10	Less-than detectable VOC
A2-2-002	H-83-L	10-12-92	1145	Sand w/wood: -6	Less-than detectable VOC
A2-2-003	H-83-L	10-12-92	1218	Sand: -10	Less-than detectable VOC
A2-3-004	H-83-L	10-12-92	1320	Sand: -6	Less-than detectable VOC
A2-3-005	H-83-L	10-12-92	1350	Sand: -10	Less-than detectable VOC
A1-1-006	H-83-L	10-13-92	0828	Sand: -5	Less-than detectable VOC
A1-1-007	H-83-L	10-13-92	0850	Sand: -10	Less-than detectable VOC
A1-2-008	H-83-L	10-13-92	0939	Wet Sand: -4	Unquantified heavy hydrocarbons
A1-3-009	H-83-L	10-13-92	1055	Sand: -6	Less-than detectable VOC
A1-3-010	H-83-L	10-13-92	1123	Sand: -10	Less-than detectable VOC
A3-1-011	H-83-L	10-13-92	1310	Sand: -5	Less-than detectable VOC
A3-1-012	H-83-L	10-13-92	1335	Sand: -10	Less-than detectable VOC
A3-2-013	H-83-L	10-14-92	0920	Sand w/wood: -6	Less-than detectable VOC
A3-2-014	H-83-L	10-14-92	0950	Sand: -10	Less-than detectable VOC
A3-3-015	H-83-L	10-14-92	1050	Sand: -6	Less-than detectable VOC
A3-3-016	H-83-L	10-14-92	1107	Sand: -10	Less-than detectable VOC
A4-1-017	H-83-L	10-14-92	1150	Moist sand: -6	Less-than detectable VOC
A4-1-018	H-83-L	10-14-92	1208	Moist sand: -10	Less-than detectable VOC
A1-1-019	PSN-04W	10-20-92	1030	Sand: -6	Less-than detectable VOC
A1-1-020	PSN-04W	10-20-92	1053	Sand: -10	Less-than detectable VOC
A1-2-021	PSN-04W	10-20-92	1153	Sand: -6	Less-than detectable VOC
A1-2-022	PSN-04W	10-20-92	1238	Sand: -10	Less-than detectable VOC
A1-3-023	PSN-04W	10-20-92	1400	Sand: -6	Less-than detectable VOC
A1-3-024	PSN-04W	10-20-92	1429	Sand/silt: -8	Less-than detectable VOC
A2-1-025	PSN-04W	10-20-92	1534	Sand w/wood: -6	Less-than detectable VOC
A2-1-026	PSN-04W	10-20-92	1559	Fine sand: -8	Less-than detectable VOC
A2-2-027	PSN-04W	10-21-92	0921	Sand/clay: -6	Less-than detectable VOC
A2-2-028	PSN-04W	10-21-92	0942	Sand/clay: -9	Less-than detectable VOC
A2-3-029	PSN-04W	10-21-92	1004	Fine sand: -6	Less-than detectable VOC
A2-3-030	PSN-04W	10-21-92	1030	Sand/clay: -8	Less-than detectable VOC
A3-1-031	PSN-04W	10-21-92	1101	Sand: -6	Less-than detectable VOC
A3-1-032	PSN-04W	10-21-92	1125	Sand/clay: -8	Less-than detectable VOC
A3-2-033	PSN-04W	10-21-92	1224	Clay: -6	Less-than detectable VOC
A3-2-034	PSN-04W	10-21-92	1250	Clay: -8	Less-than detectable VOC
A1-1-035	PSN-04E	10-21-92	1400	Sand/clay: -6	Less-than detectable VOC
A1-1-036	PSN-04E	10-21-92	1440	Sand/clay: -9	Less-than detectable VOC
A1-2-037	PSN-04E	10-21-92	1503	Sand/clay: -6	Less-than detectable VOC
A1-2-038	PSN-04E	10-21-92	1527	Sand/clay: -9	Less-than detectable VOC
A1-3-039	PSN-04E	10-21-92	1604	Sand w/wood: -6	Less-than detectable VOC
A1-3-040	PSN-04E	10-21-92	1624	Sand w/wood: -9	Less-than detectable VOC
A2-1-041	H-06-HW	10-23-92	0912	Sand/silt: -6	Less-than detectable VOC
A2-1-042	H-06-HW	10-23-92	0931	Sand/silt: -10	Less-than detectable VOC
A2-2-043	H-06-HW	10-23-92	1048	Sand/silt: -6	Unquantified heavy hydrocarbons
A2-2-044	H-06-HW	10-23-92	1128	Silt/clay: -10	Unquantified heavy hydrocarbons
A5-1-045	H-06-HW	10-23-92	1213	Sand/silt: -6	Less-than detectable VOC
A5-1-046	H-06-HW	10-23-92	1230	Silt/clay: -10	0.54 ppm (wt) PCE
A5-2-047	H-06-HW	10-23-92	1325	Sand/silt: -6	Unquantified heavy hydrocarbons
A5-2-048	H-06-HW	10-23-92	1345	Silt/clay: -10	Unquantified heavy hydrocarbons
A5-3-049	H-06-HW	10-23-92	1415	Sand/silt: -6	Unquantified heavy hydrocarbons
A5-3-050	H-06-HW	10-23-92	1500	Sand/silt: -10	Unquantified heavy hydrocarbons
A4-4-052	H-06-HW	10-23-92	1530	Sand/silt: -6	Less-than detectable VOC
A4-4-053	H-06-HW	10-23-92	1600	Silt/clay: -10	Less-than detectable VOC
A5-5-054	H-06-HW	10-26-92	0920	Sand/silt: -6	Less-than detectable VOC
A5-5-055	H-06-HW	10-26-92	0950	Silt/clay: -10	Less-than detectable VOC
A7-1-056	H-06-HW	10-26-92	1045	Silt/clay: -6	Less-than detectable VOC
A7-1-057	H-06-HW	10-26-92	1115	Silt/clay: -10	Less-than detectable VOC
A7-2-058	H-06-HW	10-26-92	1155	Silt/clay: -6	Less-than detectable VOC
A7-2-059	H-06-HW	10-26-92	1205	Silt/clay: -10	Less-than detectable VOC
A16-1-060	H-06-HW	10-26-92	1345	Silt/clay: -6	Unquantified heavy hydrocarbons

North Slope Expedited Response Action
Volatile Organics Field Screening Results

Sample #	Site	Sample Date	Sample Time	Soil Type: Depth (ft)	Results
A16-1-061	H-06-HW	10-26-92	1420	Silt: -10	Less-than detectable VOC
A16-2-062	H-06-HW	10-27-92	0907	Sand/silt: -6	Less-than detectable VOC
A16-2-063	H-06-HW	10-27-92	0927	Silt/clay: -10	Less-than detectable VOC
A19-1-064	H-06-HW	10-30-92	0830	Sand/silt w/wood: -6	Less-than detectable VOC
A19-1-065	H-06-HW	10-30-92	0842	Sand/silt w/wood: -10	Less-than detectable VOC
A19-2-066	H-06-HW	10-30-92	0915	Sand/silt: -6	Less-than detectable VOC
A19-2-067	H-06-HW	10-30-92	1000	Sand/silt: -10	Less-than detectable VOC
A19-3-068	H-06-HW	10-30-92	1015	Sand: -6	Less-than detectable VOC
A19-3-069	H-06-HW	10-30-92	1125	Sand/silt: -10	Less-than detectable VOC
A2-1-070	H-06-HE	10-30-92	1330	Sand/silt: -6	Less-than detectable VOC
A2-1-071	H-06-HE	10-30-92	1345	Sand/silt: -10	Less-than detectable VOC
A6-1-072	H-06-HE	10-30-92	1430	Sand/silt w/wood: -6	Less-than detectable VOC
A6-1-073	H-06-HE	10-30-92	1440	Sand/silt: -10	Less-than detectable VOC
A6-2-074	H-06-HE	10-30-92	1510	Sand/silt: -6	Less-than detectable VOC
A6-2-075	H-06-HE	10-30-92	1517	Sand/silt: -10	Less-than detectable VOC
A6-3-076	H-06-HE	10-30-92	1550	Sand/silt: -6	Less-than detectable VOC
A6-3-077	H-06-HE	10-30-92	1555	Sand/silt: -10	Less-than detectable VOC
A6-4-078	H-06-HE	11-2-92	0840	Sand/silt: -6	Less-than detectable VOC
A6-4-079	H-06-HE	11-2-92	0906	Sand/silt: -10	Less-than detectable VOC
A11-1-080	H-06-HE	11-2-92	1020	Sand/silt: -6	Less-than detectable VOC
A11-1-081	H-06-HE	11-2-92	1045	Sand/silt: -10	Less-than detectable VOC
A11-2-082	H-06-HE	11-2-92	1200	Sand/silt: -6	Less-than detectable VOC
A11-2-083	H-06-HE	11-2-92	1228	Sand/silt: -10	Less-than detectable VOC
A11-3-084	H-06-HE	11-2-92	1330	Sand/silt: -6	Less-than detectable VOC
A11-3-085	H-06-HE	11-2-92	1340	Sand/silt: -10	Less-than detectable VOC
A12-1-086	H-06-HE	11-2-92	1420	Sand/silt: -6	Less-than detectable VOC
A12-1-087	H-06-HE	11-2-92	1445	Sand/silt: -10	Less-than detectable VOC
A12-2-088	H-06-HE	11-3-92	0825	Sand/silt: -6	Less-than detectable VOC
A12-2-089	H-06-HE	11-3-92	0840	Sand/silt: -10	Less-than detectable VOC
A7-1-090	H-06-HE	11-3-92	0925	Silt/clay: -6	Less-than detectable VOC
A7-1-091	H-06-HE	11-3-92	1055	Silt/clay: -10	Less-than detectable VOC
H-81R-092	H-81-R	12-14-92	1100	Sand: Augar Flights	Less-than detectable VOC
H-81R-093	H-81-R	12-14-92	1135	Sand: Bottom of Well	Less-than detectable VOC
H06-L-1-094	H-06-L	12-15-92	1319	Sand: -4	Less-than detectable VOC
H06-L-1-095	H-06-L	12-15-92	1327	Sand: -2.6	Less-than detectable VOC
H06-L-1-096	H-06-L	12-16-92	0900	Sand/silt: -8	Less-than detectable VOC
H06-L-1-097	H-06-L	12-16-92	1000	Clay: -14	Less-than detectable VOC
Cis-1-098	Clay Pit Cistern	2-10-93	1010	Sand/water: -1	Less-than detectable VOC
Cis-2-099	Cow Camp Cistern	2-10-93	1145	Sand/debris: -2	Less-than detectable VOC
Cis-3-100	Homestead Cistern	2-10-93	1341	Sand/debris: -1	Less-than detectable VOC
H07-H-1-101	H-07-H Drywell	2-16-93	1505	Sand/cobble: -16	Less-than detectable VOC
H-90-102	H-90 Soil	2-17-93	0830	Oil-stained sand: -0.5	Less-than detectable VOC

APPENDIX C

BACTERIAL METABILIZATION OF 2-4,D

Date October 1, 1985

To HCCP File

From Kathy Cramer KC

Subject USBR 2, 4-D Burial Site

TJ McLaughlin
RE Wheeler (RHO)
File/LB

On September 20, 1985, a site visit was made to the "U.S. Bureau of Reclamation (USBR) 2, 4-D Burial Ground" near Wahluke Slope (R 14, T 27, 535). Tom McLaughlin and Kathy Cramer form PNL, Alan Conklin and William Osborne from Rockwell, were escorted by USBR Soil Scientist Alan Hattrup.

The disposal area is marked with two signs, at the northerly and southerly boundry (~400' apart), which state "2, 4-D Burial Site, June 1966". The area of the site approximates 400' x 60' and is located at elevation 700' (~350' above and 1/2 mile from the Columbia River), is very remote (1 mile from the nearest access road) and is at the base of an encroaching sand dune (45°, ~60' high).

The closest flowing man made water source is the WB-10 Wasteway, 1 mile to the north at elevation 684'. The closest drinking water source, according to Mr. Hattrup, was about 2 miles to the east.

The initial burial of 2, 4-D contaminated soil was generated from leaking storage tanks in Eltopia, WA in June, 1966. A second burial, in 1967, consisted of the empty 2, 4-D storage tanks.

According to Mr. Hattrup, 150 to 250 gallons of 6 pounds/gallon 2.4-D (equating to 200-1200 pounds of amine) was disposed at the site. The soil was transported to the site in dump trucks, and placed into a large shallow pit (probably dug out with a bulldozer. Little surface settling was noted. Then, in 1967 (according to Mr. Hattrup), the six storage tanks were flattened and buried in the same location.

The documentation provided on this site indicates some differences in what Mr. Hattrup recalled. Some past letters and correspondance from USBR and DOE indicate that in June 1966, 900 gallons of 2, 4-D had leaked into 50 yards of soil, and the second burial in 1967 consisted of 10 tanks that were flattened and buried.

The site has not been used post 1967, and the site vegetation has reestablished itself with cheatgrass and sage. There was evidence that coyotes, deer and other wildlife frequented the area. Burrowing animals/insects noted in the area include snakes, beetles, and ants. Evidence of the presence of a motorcycle was noted on top of the sand dune. Several shotgun shells presumably from bird hunters was also evident. One medium size, very green Russian thistle plant was observed near the center of the disposal site.

HCCP File
October 1, 1985
Page 2

2, 4-D (2, 4-Dichlorophenoxyacetic acid), is used as a commercial herbicide. Of primary concern in this situation is its persistance in the soil. More specifically, the ability of the pesticide to be transported with eroding soil particles to hearby waterways and the accumulation in insects and earthworms which would show up in high levels and other wildlife feeding in the area.

Fortunately, 2, 4-D is one of the only herbicides which is able to be metabolized by bacteria. As shown in the diagram below, the breakdown rate approximately thirty days. Therefore, with some site specific soil and water samples an analysis for 2, 4-D should show no traces of the herbicide.

The only known or potential noteworthy concerns associated with the site are public relations (i.e., public has access to the site and can observe signs and possibly animal intrusion.) For more additional information, see correspondence between DOE and USBR in the HCCP files and photographs.

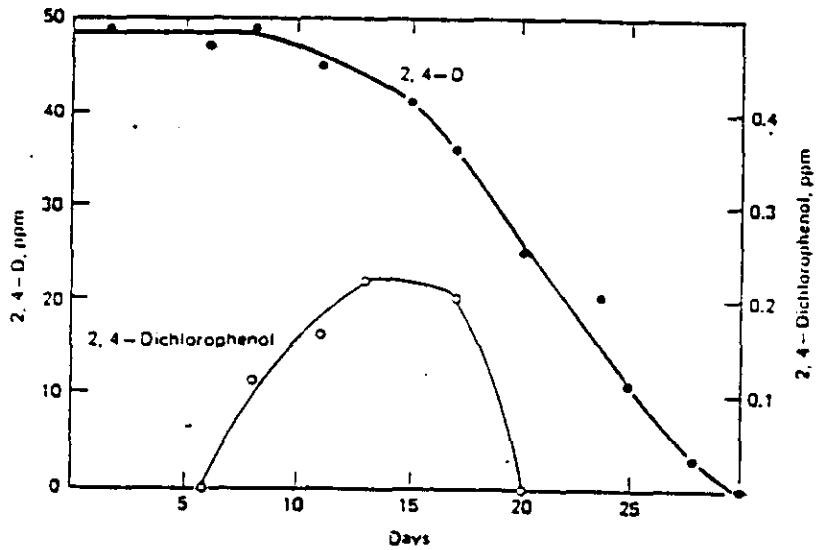

Figure 26.4. Metabolism of 2,4-D (2,4-dichlorophenoxyacetic acid) and formation of 2,4-dichlorophenol in soil (28). Note that the concentration of the product is low.

KHC:sc

APPENDIX D

COST ESTIMATES

The following cost estimates were made for each of the activities associated with the two alternatives retained for evaluation in Chapter 5.

FLORA AND FAUNA SURVEY

It is estimated that this activity will take 3 wk to complete. One week of actual field inspection of the sites, which may be disturbed and 2 wk to prepare the report detailing the results of the field survey and any required operating practices that will be necessary in mitigating impact to the local biota.

Field Survey:	$3.2K	(2 Exempt Employees @ $40/hr)
Report Preparation:	3.2K	(1 Exempt)
Supplies:	1K	
Contingency:	1.9K	
TOTAL:	**$9.3K**	

BACKFILL CISTERNS

There is a total of nine known cisterns located on the North Slope. These concrete-lined pits have vertical walls and range from a 2 to 14 ft in depth. It is estimated that is will take approximately 2 wk (including mobilization) to backfill these structures with clean sand/gravel from local sources. All easily accessible trash will be removed prior to backfilling (NOTE: Personnel will not be allowed to access the structures.) The major driving costs for performing these activities were estimated as follows:

Labor:	$ 9.6K	(1 supervisor, 3 teamsters @ $30/hr)
Equipment:	2.5K	
Fuel:	1K	
Contingency:	3.3K	
TOTAL:	**$16.4K**	

DEMOLISH UNDERGROUND STRUCTURES

There are three underground structures which will require dismantling. Two of these structures are still standing. Access into these structure is restricted. Field screening samples from the soils beneath the floors of these structures will be taken utilizing a backhoe. The backhoe will collapse the roof and move the materials to one end of the structure. The sample material will then be obtained for field screening analysis. If there is no indication of environmental hazards, the walls of the structure will be

collapsed and the resulting pit backfilled. It is assumed these activities will take 1 wk to complete. The major driving costs for performing these activities were estimated as follows:

Labor:	$7.2K	1 supervisor, 5 teamsters
Field Screening:	2K	
Equipment:	1.5K	
Fuel:	1K	
Contingency:	2.9K	
TOTAL	**$14.6K**	

SURFACE TRASH PICKUP

It is assumed that a 4-wheel drive pickup can be used to access the location of the surface debris (some of the sites are remote). It is estimated that the removal activities will take 2 wk to complete. Concrete rubble, foundations, etc., will be left in-place as they provide biota habitat. A small contingency has been included for field screening activities which may be required if suspect hazardous wastes are found (very little of the waste is expected to be suspect).

Labor:	$ 9.6K	1 supervisor, 3 teamsters
Field Screening:	1K	
Waste Disposal:	2.7K	($27/yd^3 @ 100yd^3)
Equipment:	2.5K	
Fuel:	1K	
Contingency:	4.2K	
TOTAL	**$21K**	

ORDNANCE SURVEY

The costs associated with the ordnance survey are based on an estimate provided by the U.S. Army Corps of Engineers. The survey was for completing a survey of the entire Hanford Site. This estimate was for $292,000. Since the North Slope area comprises 25% of Hanford's 560 mi^2, the cost for performing the North Slope portion of this survey is $73,000. This cost includes only those costs associated with locating ordnance and does not include the cost of removing identified items (the estimate from the Corp included contingencies).

TOTAL: $100K

REMOVAL OF OIL CONTAMINATED SOILS

It is estimated that a total of 4 yd^3 of oil-contaminated soils exist at the concrete grease rack and the drywell located at Nike missile site H-81-R. This material is in excess of MTCA action levels for lead and total petroleum

hydrocarbons. Due to the small volume of contaminated material, treatment alternatives were considered to be too expensive and time consuming.

The removed material will be placed into 55-gal drums. The area the waste was removed from will be screened using field techniques for TPH. Once no contamination is found using the field technique, a series of samples will be taken for offsite confirmatory analysis. It is estimated that the removal activity will take 2 days to complete. The material will be disposed of in an approved hazardous waste landfill.

Labor:	$ 1.9K	(1 supervisor, 1 Teamster, 2 D&D)
Field Screening:	2K	
Laboratory Analysis:	12K	(4 samples @ $3,000/sample)
Waste Disposal:	10.5K	(15 drums @ $700/drum)
Equipment:	2.5K	
Fuel:	1K	
Contingency:	7.5K	
TOTAL:	**$37.4K**	

GLOBAL POSITIONING SURVEYS

The global positioning surveys will be performed at each of the documented sites. This includes the landfills, drywells, cisterns as well as the military positions in general. It is estimated that the field surveys will take 1 week to complete. Data processing activities will take an additional week.

Field Survey:	$4.8K	(3 Exempt @ $40/hr)
Data Processing:	1.6K	(1 Exempt @ $40/hr)
Equipment/Supplies:	1K	
Contingency:	1.9K	
TOTAL:	**$9.3K**	

GROUNDWATER WELL ABANDONMENT

An evaluation of each well will be made to determine if each of the wells may offer a beneficial use. If a use can be found and the necessary funds for maintaining the well, the well may be remediated. It is assumed at this time, that the wells will be abandoned in accordance with the WAC 173-160.

Well Evaluation:	$ 346K	(8 Wells)
Well Decommissioning:	1,003K	
Contingency:	337K	
TOTAL:	**$1,686K**	

LANDFILL STABILIZATION

It is estimated that stabilization of landfill subsidence areas will take 3 wk to complete. Activities for completing this task include performing a site survey at each landfill identifying the areas requiring stabilization. Once the survey of the area is completed, the stabilization activities will be completed. It is estimated that these activities will take 3 wk to complete.

Labor:	$14.4K	(3 teamsters, 1 supervisor @ $30/hr)
Equipment:	7K	
Fuel:	3K	
Contingency:	6.1K	
TOTAL:	**$30.5K**	

LANDFILL EXHUMATION

The cost estimate presented below is based on calculation of the major items driving the cost of the project. These items are labor, fuel, equipment lease, and waste disposal charge. Each of these is sensitive to the distance from the waste site to Central Landfill Facility and the volume of waste. The approximate distance from each site to the Central Landfill Facility is presented in the Table A-1. Also included in the table is the distance from the dust control water location. Working days includes 3 days per site for staging and demobilization.

Table A-1.

Site Name - Type	Round Trip to CLF (miles)	Round Trip to Water (miles)	Working Days
PSN 72/82 - Antiaircraft	50	11	10
H-83C, 81R - Nike	54	6	12
PSN 80 - Antiaircraft	58	5	8
PSN 90 - Antiaircraft	66	8	8
PSN 01 - Antiaircraft	74	16	9
PSN 04 - Antiaircraft	80	16	10
PSN 7/10 - Antiaircraft	84	10	10
H06L - Nike	84	10	17
H12L - Nike	96	3	19
PSN 12/14 - Antiaircraft	98	6	11

The working crew for each shift consists of 3 heavy equipment operators, 15 drivers, 4 D&D, 2 supervisors, 1 engineer/health and safety, 1 CLF operator, 1 miscellaneous craft. Hanford labor rates were used to calculate these costs. For each shift, the labor cost was $10,432. It was assumed that operations would be conducted two shifts per day and 6 hr per shift would be actual removal and hauling, or staging. The total labor cost estimate is $2,942,000.

It was assumed that the office, change, and lunch trailers are on hand as well as the portable generator, water pump, light trucks and vehicles, and a tractor for moving the trailers. The following equipment would be leased: 14 20-yd^3 dump trucks, three water trucks, one bulldozer, two front-loaders, and one grader. The number of trucks was determined by the estimated turnaround time. Twelve trucks with two in reserve would do the waste hauling. Maintenance costs for the trucks are included in the lease cost. Fuel would have to be provided. The total estimated lease cost is $1,334,000. The total estimated fuel cost is $310,000.

A 25% contingency is added to the labor, lease, and fuel costs. This comes to $1,147,000.

The volume of waste was estimated to be 20,168 yd^3 for each Nike site and 12,100 yd^3 for each antiaircraft site. This is based on the estimated size and configuration of the landfills previously described. The total waste volume is 145,206 yd^3. The Central Landfill Facility charges $27.00/$yd^3$. For all the waste this comes to $3,920,000.

Landfill excavation total - $9,653K.

This estimate does not include removal of the building debris or foundations which are still in place. It also does not estimate volume reductions (and subsequent cost saving) which could be realized by some type of sorting or screening of the bulk material. It is estimated that removal of this material would double the volume estimate of material to be excavated. This results in a total cost for removal of $19,306,000. This material also contains a significant quantity of transite and other asbestos based material.

Complete Removal including demolition debris - $19,306K

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